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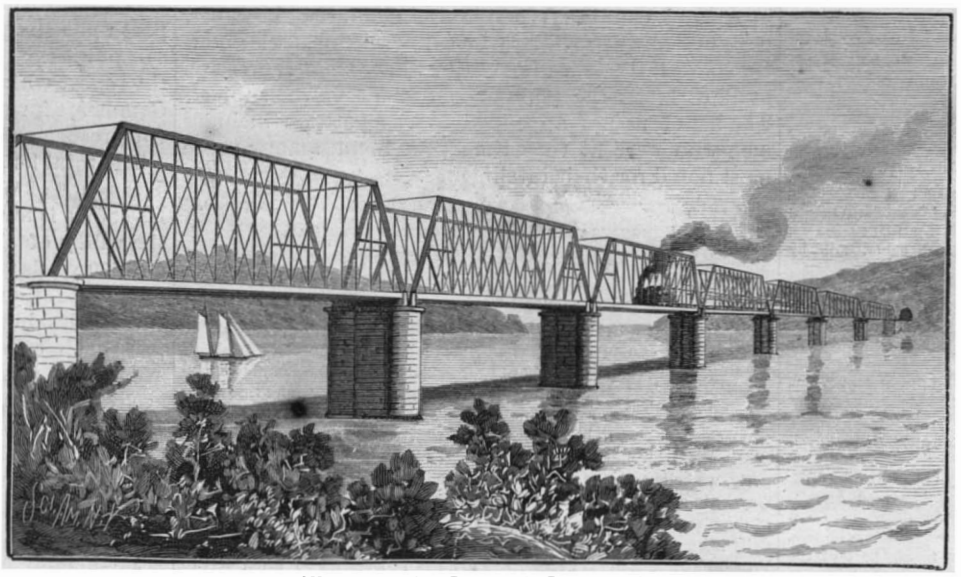
THE DEEPEST FOUNDATION IN THE WORLD.

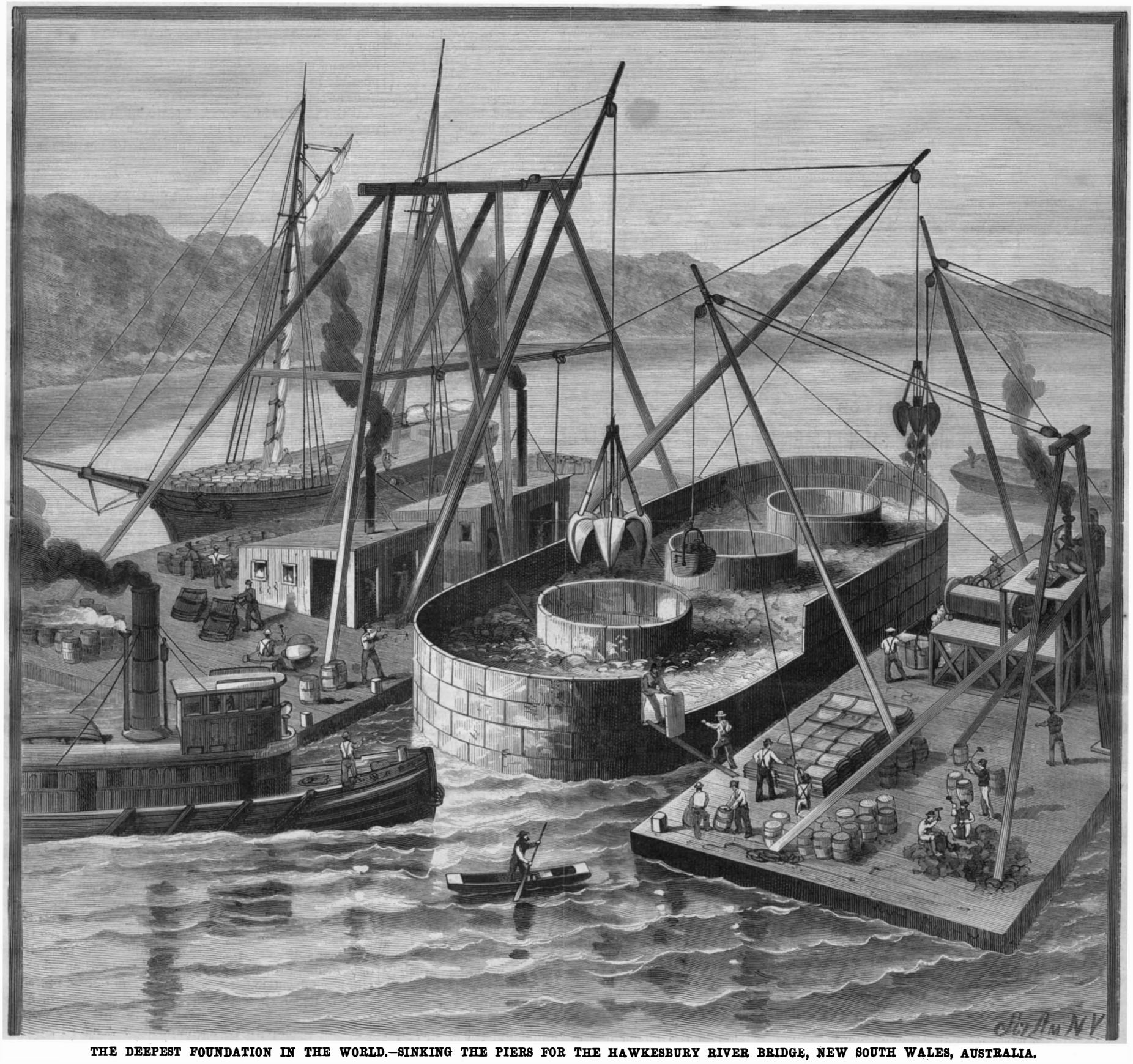
In November, 1884, the Government of New South Wales, Australia, invited bridge builders throughout the world to send plans and tenders for building a double-track steel railway bridge across the Hawkesbury River, some thirty miles north of Sydney. This resulted in bids from firms in the United States, Canada, Belgium, France, England, Scotland, and Australia. The plans were referred to a commission of three eminent English engineers, who decided that although several of the plans for the superstructure were meritorious enough to warrant selection, the plans of the Union Bridge Company, of this city, for the foundations, were the only ones that could be recommended.



THE HAWKESBURY RIVER BRIDGE AUSTRALIA.

The bridge will have a total length of 2,896 feet, composed of five spans of 416 feet each between centers of piers, and two spans of 408 feet each. The width will be 28 feet between centers of trusses, the design of which is shown in the accompanying perspective view of the completed structure. All of the superstructure is to be of mild steel, having an ultimate tensile strength of not less than 67,000 pounds and not more than 73,920 pounds per square inch of section. One of the requisites is that when heated to a cherry red and cooled in water of 82°, the test pieces, cut either lengthwise or crosswise from the material, must bend double without flaw or crack to a curve having an inner radius of 1½ times the thickness of the plates.

(*Continued on page* 292.)



THE DEEPEST FOUNDATION IN THE WORLD.—SINKING THE PIERS FOR THE HAWKESBURY RIVER BRIDGE, NEW SOUTH WALES, AUSTRALIA.

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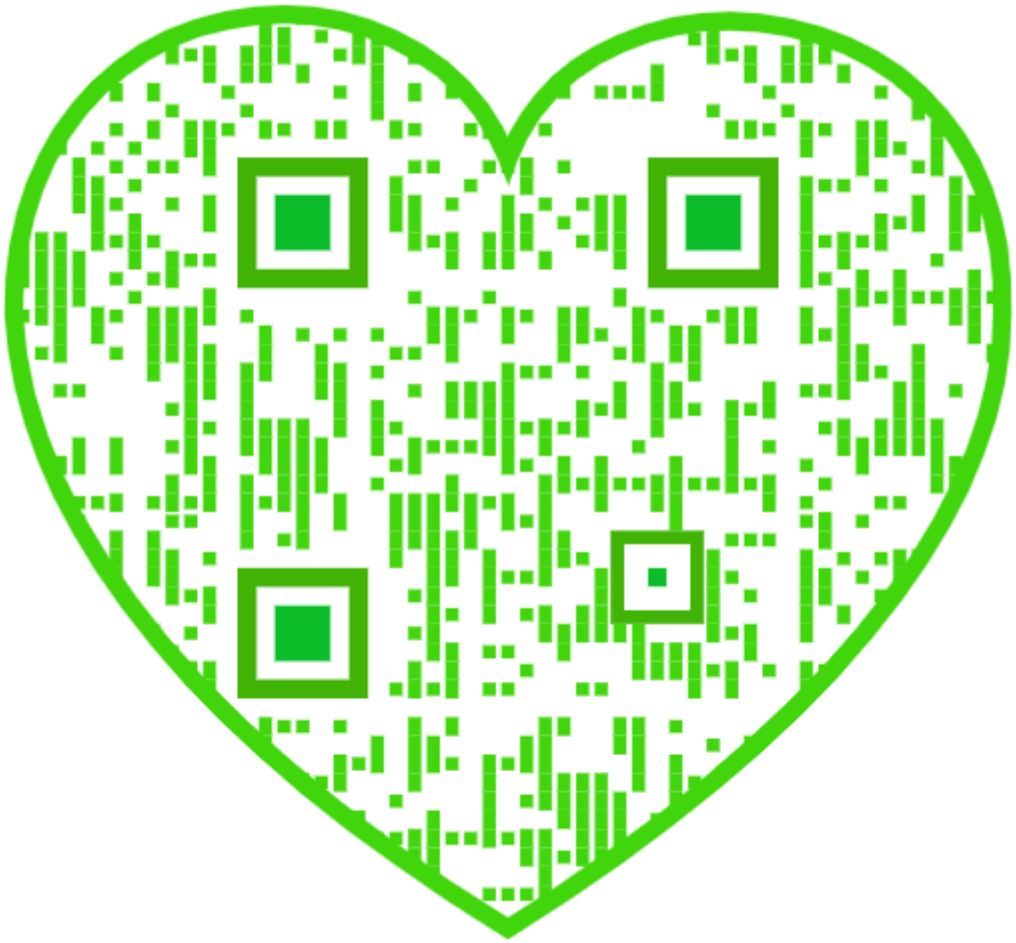

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NEW YORK, SATURDAY, MAY 8, 1886.

Contents.

(Illustrated articles are marked with an asterisk.)

Automatic cut-out and lightning arrester*..... 291
Books and publications, new..... 297
Boy, the, don't undervalue..... 290
Business and personal..... 297
Club house, new, of the St. Louis Jockey Club*..... 295
Comets Fabry and Barnard..... 289
Concrete, a cheap..... 296
Copying press, Haines'*..... 290
Crusher and stamp mill combined*294
Electricity, instrument for producing at will an invariable amount of..... 291
Expansion produced by amalgamation..... 293
Fire damp, a use for..... 291
Fluids and solid metals, properties of..... 296
Foundation, deepest in the world*..... 287, 292
Gambetta's brain..... 289
Hook, bale and box*..... 298
Inventions, agricultural..... 297
Inventions, engineering..... 297
Inventions, index of..... 299
Inventions, miscellaneous..... 297
Inventions, notable, opposition to 290
Leveling apparatus for steam boilers*..... 290
Lightning arrester for dynamo machines*..... 291
Magenta, how made..... 293
Manufacturers must be on the alert..... 295
Mineral waters of the United States..... 289
Notes and queries..... 298, 299
Old age, premature, how to avoid 296
Panama Canal, condition of..... 288
Photographic notes..... 289
Poisoning case, singular..... 294
Postal stamp system, invention.. 295
Pulverizer, improved, Howland's*291
Rectangular proportion..... 293
Rifle, magazine, "Remington-Lee"..... 292
Saw without teeth, a..... 290
Teeth, separating, device for*.... 293
Tirl, a Shetland..... 292
Type and overlay, perforating*.. 290
Type writer, Remington..... 289
Ventilator, rotary, improved*.... 291
Wagon coupling*..... 290
Westinghouse, George..... 290
Wood, oiling..... 289

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 540.

For the Week Ending May 8, 1886.

Price 10 cents. For sale by all newsdealers.

PAGE

I. CHEMISTRY AND METALLURGY.—Copper, Cadmium, Zinc, Nickel, etc.—Their successive separation..... 8615
Impurities in Metals.—Abstract from a lecture by Professor W. C. ROBERTS-AUSTEN.—2 figures..... 8617
Reaction of Tin with Sulphuric and Nitric Acids.—By H. BASSETT 8623

II. ENGINEERING.—Compound Engine of the Steamship Prometheus.—With two full pages of engravings..... 8617
The Austrian Torpedo Boat Falke.—With engraving..... 8620
Car Couplers.—By Prof. S. W. ROBINSON.—Need of a new coupler.—Points to be considered.—Conclusions drawn..... 8620
Sibley College Lectures.—Fire.—By J. C. HOADLEY.—Fire-sustaining substances.—The thermal unit.—Specific heat.—Rate of coal combustion.—Heat carried away by flue gases.—Effect of boiler pressure.—Temperature of flue gases, etc..... 8624

III. TECHNOLOGY.—Automatic Weighing Machine.—3 figures..... 8615
Automatic Apparatus for Washing Negatives.—1 figure..... 8616
New Extractor for Dye Woods.—1 figure..... 8616
New Style of Ox Shoes.—2 figures..... 8616
Apparatus for Distributing Liquid Carbonic Acid by Measure.—2 figures..... 8616
Butter and Oleomargarine.—From the report of the Massachusetts State Board of Health..... 8616
The Diffraction Spectrum applied to Developing Room Illumination Problems..... 8623

IV. ELECTRICITY.—New Method of Annulling the Effects of Induction in Telephone Circuits.—3 figures..... 8627

V. ARCHITECTURE.—The New Court House at Neuilly-on-the-Seine.—With engraving..... 8622
The Town Hall of Funfhaus, near Vienna.—With engraving..... 8623

VI. BIOLOGY.—Changes of Form in the Motions of the Animal Cell.. 8630

VII. HORTICULTURE.—How to Graft.—Cleft grafting, groove grafting, slip grafting, etc.—11 figures..... 8629

VIII. MISCELLANEOUS.—Durability of Resinous Woods.—By H. MAYR.—Production of resin.—Composition of resin.—Difference between heart-wood and sap-wood.—Amount of resin in different kinds of woods..... 8622
The International Fleet in Suda Bay, Crete.—An international regatta.—3 engravings..... 8628
Hog Cholera.—By W. J. SULLIVAN.—From the Connecticut State Board of Health..... 8628

OPPOSITION TO NOTABLE INVENTIONS.

Those who by reason of constitution, habit, or ill humor are continually opposing progressive ideas and inventions might learn a profitable lesson, if they would glance for a moment at the history of almost any of our important improvements, and study, through the perspective of several decades, the ungraceful position of those who then maintained a similar attitude toward the advanced projects of their times.

In the presence of electricity, we may find the uncertain gas flame and the harmful products of combustion comparatively objectionable, but for upward of half a century we have considered its illumination a great advantage, after the more primitive methods of lamp and candle. When first introduced, however, our ancestors can scarcely be called enthusiastic about the fluid, if the following curious document represents at all correctly the popular sentiment on the subject. The list of names appended to the petition includes men who were at that time prominent among those most noted for their intelligence.

PHILADELPHIA, Nov. 28, 1833.

REMONSTRANCE AGAINST LIGHTING WITH GAS.

To the Honorable the Select and Common Councils of the City of Philadelphia:

GENTLEMEN: The Subscribers beg leave respectfully to remonstrate against the plan now in agitation for LIGHTING THE CITY WITH GAS, as they consider it a most inexpedient, offensive, and dangerous mode of lighting. In saying this they are fully sustained by the accounts of Explosions, Loss of Life, and great destruction of property, where this mode of lighting has been adopted.

We consider GAS to be an article as IGNITABLE AS GUNPOWDER, and nearly as fatal in its effects: as regards the immense destruction of property, we believe the vast number of fires in New York and other cities, may be in a great measure ascribed to this mode of lighting; the leakage of the pipes and carelessness of stopping off the Gas, furnish almost daily instances of its destructive effects. When we consider that this POWERFUL and DESTRUCTIVE AGENT, must necessarily be often left to the care of youth, domestics and careless people, we only wonder that the consequences have not been more APPALLING. It is also an uncertain light, sometimes suddenly disappearing and leaving the streets and houses in total darkness.

The *Waters of the Delaware and Schuylkill*, now considered the most pure and salubrious in the world, as many long voyages have fully tested, must soon, we fear, experience the deterioration which has reduced the WATERS of the THAMES to the present impure and unhealthy State, for no reservoir will be able to contain the immense fetid drains from such an establishment, and very soon the river must be their receptacle to the destruction of the immense Shoals of *Shad*, *Herring*, and other fish with which they abound; the same cause must produce like effects. *Salmon*, *Smelts* and other fish, formerly caught in vast quantities in the Thames have nearly all disappeared. The constant digging up of the streets, the circumstance of the gas pipes which at the intersection of each square must come in contact with the water pipes, are difficulties and evils which we would anxiously avoid.

In conclusion we earnestly solicit that the lighting of our *city with oil may be continued.*

And your petitioners, etc., etc.

P. Syng Physick,	Charles H. Dingee,	Horace Binney,
Jno. S. Warner,	Hartman Kuhn,	Geo. Pepper,
John Sergeant,	Richard Alsop,	Benjamin Chew,
Jacob Ridgway,	Charles Wharton,	E. Styles Ely,
Paul Beck,	John Perot,	Henry Pratt,
Elihu Chauncey,	Jas. C. Fisher,	Roberts Vaux,
Jos. P. Norris,	John Markoe,	Thos. Allibone,
Geo. W. Smith,	Jno. C. Cresson,	Mat. Newkirk,
W. L. Hirst,	Wm. Platt,	Edw. A. Souder,
Wm. J. Duane,	H. Hollingsworth,	Hymen Gratz,
V. L. Bradford,	David Paul Brown,	Wash. J. Duffee,

And several hundred others.

But unreasonable as these apprehensions now appear, they were scarcely comparable with those excited a few years previously by Stephenson's newly invented locomotive. At a time when the commerce between Liverpool and Manchester was absolutely crippled for want of adequate transportation, and a company of gentlemen who had sufficient confidence in the eminent inventor to risk the necessary means stood ready to undertake the construction of a railway between the two cities, so powerful and so prejudiced was the opposition the enterprise encountered that its success for some time remained very doubtful. When the proposition was before Parliament, in 1825, pamphlets were issued offering every possible objection, and the newspapers declared the scheme impracticable and pernicious. It was affirmed that the cows near the line of the road would stop grazing and the hens no longer lay eggs; that birds would die from the poisonous gases discharged from the smokestack, and the preservation of pheasants and foxes be no longer possible.

People were seriously assured that the sparks would certainly set fire to fields and houses, while the air would be polluted with smoke. Prospective passengers were warned that they could not breathe in a train going so rapidly, and that they would be made worse than seasick. Farmers were frightened by the statement that there would be no further use for horses, and with the extension of the system the species would become extinct, and oats and hay would be unsalable. The boilers, it was said, would burst, the country inns be ruined, and the proper caste distinctions be broken down by such indiscriminate traveling. Failing to convince a people threatened with such a series of calamities, the assailants of the new invention took comfort in the belief that even were the railroad ever built, the weight of the locomotive would completely prevent its moving, and that the trains could never be worked by steam. Stephenson's tunnel was found very depressing; it was stated that "the sudden emersion in the gloom of the tunnel and the clash of reverberated sounds in a confined space combined to produce a momentary shudder, an idea of destruction, a thrill of annihilation!"

Yet these statements came from men not altogether unaccustomed to progress. The humiliating failure of their prophecies might well restrain more modern doubters from placing limitations upon the possibilities of the future.

CONDITION OF THE PANAMA CANAL.

It will be remembered that when M. De Lesseps and his party inspected the Panama Canal, in February, they were accompanied by Mr. John Bigelow, as the representative of the New York Chamber of Commerce. He was, by request, a guest of the Canal Company, and went with the special mission of preparing a report upon the present condition of the work, for American publication. Mr. Bigelow has now returned, and the report which he has presented to the Chamber of Commerce furnishes a trustworthy account of the present prospects of the Interoceanic Canal.

The total length of the projected canal is 46½ miles. The depth of navigable water will be about 28 feet. Its course is for the greater part of the way through the valley of the Chagres. A basin 1,600 yards long and 110 yards wide will be necessary at Panama for the accommodation of vessels, and another one, about three miles long, at Tavernilla, to permit vessels to pass each other. The total excavation necessary to accomplish this result is 120,000,000 cubic meters. The excavations made up to Dec. 31, 1885, amounted, by contract, to 11,490,196 cubic meters, and by the company to 1,520,837 cubic meters. During January, 1886, 1,067,823 cubic meters were excavated, giving a total up to Feb. 1 of 14,678,856 cubic meters. This left 105,821,144 cubic meters still to be removed.

These figures make any comment unnecessary. Mr. Bigelow states that it is impossible to say what the final cost of the work will be, or when it can be completed. There were at the time of his visit 15,000 men employed. At the present speed, this force can probably excavate 12,000,000 cubic meters a year. Could the force and machinery be trebled, it would probably be possible to finish the work in 1889. The report mentions as some of the disadvantages to be encountered that the work is in a foreign state, under a weak and unsettled government; in one of the most unhealthy regions on the continent, subject to earthquakes, within 450 miles of the equator, and under a tropical sun, where acclimated labor only is of any service. Everything for the prosecution of the work has to be imported. The country itself supplies absolutely nothing but the site for the canal. So much of the work is experimental that it is believed to be impossible for even the most eminent engineers to make estimates which have greater value than mere conjectures. The most serious difficulties to be overcome may be enumerated under four heads:

First, the control of the waters of the Chagres River, which, in the rainy season, if unrestrained, is liable to flood the larger part of the canal every year. It would be possible to control the river by the construction of an immense dam, or by the enlargement of the derivative channels by which the flood could be carried off, but either work would be very costly.

Second, the cut through the Andes at Culebra. The removal of some 22,000,000 cubic meters of earth and rock at this cut through the Cordilleras has been confided under contract to an Anglo-Dutch Company, which engages to finish the work by July 1, 1889. The contractors are to be paid $32,000,000. But they have not performed their contract more than one-sixth as rapidly as they agreed to, and at the present rate it will take them fifteen years to finish.

Third, keeping that section of the canal which runs from La Boca toward the Island of Perico, in Panama Bay, from being filled in by the ocean and the Rio Grande. The obstacles to be overcome in effecting this result are regarded as very serious, though not insurmountable.

Fourth, securing the amount of labor required at practical rates. The climate is described as one where "life dies and death lives." The natives, having no wants beyond those supplied by nature, will not work, and the difficulty of securing enough men is tremendous. To supply the deficiency, M. De Lesseps has invented a great many machines, so to do away with hand labor as far as possible.

In conclusion, Mr. Bigelow regards the canal as an undoubted possibility if sufficient funds be provided, but he ventures no opinion as to whether they will be, or what sum or what amount of time would be necessary to complete the work. The report shows that from all sources $120,000,000 have been received, but not how much has already been expended. The International Congress of 1879, which was the parent of the present Panama Canal Company, estimated the total cost at $213,500,000. It would seem from the data at hand that at least half of the estimated cost will have been expended by the end of the present year, at which time four-fifths of the excavation, not to speak of the supplementary or precautionary work, will still remain to be accomplished. There is, however, one favorable consideration in the midst of so

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much that is discouraging. It seems that a large part of this expenditure was incurred in preparations for building the canal, more, indeed, than upon the canal itself. This being the case, it may be assumed that the remaining portion of the work will cost considerably less in proportion than that already accomplished. A comparison is drawn between the Suez Canal and that at Panama, but it is admitted that the latter work is vastly more perplexing and more costly. As the spectacle of 60,000 men toiling to connect the two oceans is one which is not likely to be presented during the present decade, it is not probable that the canal, if ever completed, will be within the specified time. It will operate strongly against De Lesseps' schemes for raising more money that not only is the cost of the work an unknown quantity, but the revenues and maintenance are equally indefinite.

MINERAL WATERS OF THE UNITED STATES.

It appears from Mr. Peale's monograph on the subject that the consumption of mineral waters in the United States is annually increasing. Though the supply for this demand is drawn largely from abroad, the utilization of our native springs is receiving greater attention each year. In the decade beginning with 1873, the importation of mineral waters of all kinds increased from 394,423 to 1,714,085 gallons. Since 1883, a smaller quantity has been imported, but the increase in the domestic production has been sufficient to supply the deficiency and maintain the proportionate growth of the total consumption.

As yet, the majority of American mineral springs are unimproved. This is due mainly to the comparative newness of the country, and to the consequent inaccessibility of many of them, particularly in the Territories and extreme Western States, and also to the fact that few of our native mineral waters have been as carefully studied as those of foreign springs. People are realizing the importance of these investigations before a spring can be possessed of any value, for the indiscriminate use of mineralized waters has been shown to be not only unproductive of beneficial results, but in many cases to be absolutely injurious. There are, however, sufficient inducements in the profit arising from a well known and well patronized spring to make their improvement and study a matter of but a few years. Economically, they are interesting to their owners in a number of ways. As places of resort, they add to the wealth and population of the districts in which they occur; and the sale of the water, either on the spot or when bottled and shipped to a distance, is often a source of considerable profit.

Though all spring waters are more or less mineralized, the term is limited to those which contain a sufficient amount of mineral matter to have a medicinal effect upon the system. Mr. Peale adds to this definition, "or are characterized by an unusual degree of heat." Evidently, he is not a believer in the tenets of substantialism, for the savants who support this school have announced the retrogressional discovery that heat, or caloric, is a substance; and since it belongs neither to the animal nor vegtable kingdom, it must, by negative reasoning, be a mineral. The therapeutic value of hot water in the treatment of dyspepsia being well known, hot springs would, according to this doctrine, come under the head of mineral waters, without special mention. It is unnecessary to say that we have omitted them for a different reason. By a coincidence, not unnatural, most hot springs are mineralized, but we see no reason why simply thermal springs should be included in this classification. The hot springs of Arkansas, Colorado, New Mexico, California, and other less known localities are for the most part highly charged with chemical salts and gases. A consultation of the mineral spring localities shows that there is scarcely a State or Territory in all our broad domain which is not liberally supplied with mineral springs, many of which possess marked medicinal properties. The majority of these will be improved and utilized in time, and it is probable that an even larger number will be brought to public notice in the future. What is wanted at present, however, is not so much a knowledge of additional springs as of the waters of those already discovered. Many noted resorts in Europe, which were at one time obscure villages, owe their importance to the discovery and utilization of their mineral waters. It is quite safe to predict that many a lonely spring, which is now tasted only by a passing frontiersman or a thirsty Indian, will some day cause a similar metamorphosis.

COMETS FABRY AND BARNARD.

Two comets, visible to the naked eye and not far apart, will be the marked features of the northern sky during the latter part of April and the beginning of May. They are known on astronomical annals as comets Fabry and Barnard.

Comet Fabry was discovered on the 2d of December, 1885, by M. Fabry, of the Paris Observatory. It was a very faint telescopic comet, merely a misty speck in the sky, and gave little token of the importance it was destined to attain. It was, however, approaching the sun, and increasing in size and intensity. It passed its perihelion on the 5th, and is moving rapidly northward. It was seen with the naked eye by a European observer about the 27th of March, and on the 8th inst. by an American observer. The former observer found it a difficult object on account of its low position in the heavens and its nearness to the sun. The latter observer describes it as a hazy star with a faint tail, visible in the northeastern sky from 2 o'clock until the morning dawn.

Dr. S. Oppenheim, an assistant in the observatory at Vienna, gives the following ephemeris of the comet until the 30th of June:

Date.	R. A.	Dec.	Intensity.
May 1·5	3 h. 10 m.	55° 47′ N.	666·80
May 16·5	8 h. 21 m.	16° 3′ N.	192·41
May 31·5	9 h 12 m.	27° 49′ S.	15·58
June 30·5	10 h. 34 m.	36° 41′ S.	2·07

The figures under the head of "Intensity" give the comparative increase in brightness since its discovery, that period being represented by unity.

Comet Fabry will be at its nearest point to the earth about the 1st of May. Its intensity will then be more than six hundred times as great as when discovered.

This is the case according to Dr. Oppenheim's computation, and his estimate is indorsed by Weiss, the director of the Vienna Observatory. Other computers do not give so large an estimate, making the comparative brightness five hundred, four hundred, and even only one hundred times greater than unity. The position of the comet may easily be found on a star map or chart, when the right ascension and declination are given.

On the 1st of May the comet will probably be in the constellation Perseus, and will be visible during nearly the whole night. We say "probably," for there seems to be an unusual discrepancy in the ephemerides of the various computers, and cometic movements are always uncertain. On the 16th of May the comet will be found among the small stars of Cancer, and, quickly losing its transitory brightness, will be lost to the view of northern observers.

We may therefore hope to behold a comet in a good position for observation with the naked eye, and one that may be easily recognized. But the celestial stranger will make a short stay, and observers must eagerly watch for its appearance. Neither must any wonderful show be expected. The highest estimate, six hundred and sixty-eight times the original intensity, is nothing very remarkable, for the comet was nothing but a misty point when first seen by M. Fabry, making its way through the great square of Pegasus.

Barnard's comet, discovered by Prof. Barnard, of Nashville, Tenn., on the 4th of December, 1885, promises to be visible at the same time, although it is not as bright as Fabry's. It will be in perihelion some time during the first week in May, and will be at its nearest point to the earth about the end of May. It will be in the constellation Andromeda early in May, when its brightness will be one hundred times greater than when discovered. If computations are accurate, there is a prospect of beholding two comets visible to the naked eye in two neighboring constellations on the early mornings about the 1st of May, in the northeastern sky, and when the moon is not in an aspect to dim the mild luster of their shining.

PHOTOGRAPHIC NOTES.

Balloon Photographs.—We were recently shown a series of excellent photographs (5 x 8 in. size) made in October, 1885, by John B. Doughty, photographer, and Alfred More, an amateur aeronaut of Winsted, Conn. A special balloon was constructed by Mr. More for the purpose, the basket having a central aperture in the bottom large enough for the lens to project through. It was thought by pointing the lens through the aperture the effect of the gyratory movement of the balloon would be in a measure overcome. The exposures made through this aperture, however, were no more satisfactory than the plan mostly employed, which was to hold the camera in one hand over the side of the basket and release the shutter with the other.

The balloon started off at one o'clock in the afternoon and descended at seven.

Several of the views taken at different altitudes showed distinctly the winding rivers, the peculiar contour of the different farms, particularly their irregular shape, and the location of woods and railroad tracks. The views were in fact complete maps of the country over which the balloon floated.

The most curious pictures were of banks of clouds; one in particular, looking toward the edge of fleecy clouds, had the appearance of surf rolling on the beach.

During the trip a remarkable mirage effect occurred; there appeared to one side of the balloon against a bank of clouds the shadow of the balloon cast by the sun, and also the shadow of an inverted balloon, the bottom of each basket joining, while extending in the shape of a disk from the neck of each balloon was a beautiful circular rainbow.

An exposure was made upon this, but unfortunately the plate was afterward accidentally damaged. Mr. Doughty made a sketch of the appearance. His description of the phenomenon shows that it must have been very beautiful.

Other pictures showed the interior of the balloon while inflated with air, also as it appeared after the descent.

All the pictures were distinct and well focused, and were taken with an ellipse Prosch shutter at its highest speed.

The use of the balloon, in combination with the camera, for taking panoramic and bird's eye views is likely to be extended, but it will be particularly valuable in case of war for securing correct maps of the location of the enemy's lines. By using sensitive paper in place of heavy glass plates, larger pictures can be taken without increasing the load.

The sensation of floating along quietly in the air is said to be very agreeable.

Exhibition of Photographs.—We were recently invited to inspect a very creditable exhibition of photographs representing the first annual exhibit by the Pittsburg Society of Amateur Photographers, of Pittsburg, Pa.

Much of the work shown was of a high character for so young a society; some architectural views by Mr. Geo. S. Orth, instantaneous views by Mr. A. S. Murray, the president, landscapes by Mr. W. S. Bell, portrait composition by Mr. J. B. Clark, mechanical views and blue prints by Mr. Perrine, were all excellent specimens of amateur work.

This society, being located in the midst of a great manufacturing and railroad center, has abundant opportunities for making a photographic record of the progress of important industries.

The exhibition was opened by a reception on Thursday evening, April 15, and terminated on the evening of the 16th with a lantern exhibition, at which there was a large attendance.

THE REMINGTON TYPE WRITER.

Some time previous to the failure of the firm of Remington & Sons, all the rights to manufacture their celebrated type writer had been secured by the firm of Wyckoff, Seamans & Benedict. As the latter firm now owns every department, they will, in the future, make a strong endeavor to improve, if possible, the Remington type writer, and will use every means to keep the supply equal to the demand, which has not been the case in the past, although no less than nine hundred machines were sold during the month of March.

Gambetta's Brain.

At a recent meeting of the Anthropological Society of Paris, a report by MM. Duval and Chudzinski was read on the brain of M. Gambetta. The third frontal convolution was highly developed, the upper part of it being reduplicated.

Reference was made to the brains of persons of low intelligence, and also to the prominence of Broca's convolution in the brains of Wulfert, the lawyer, and Huber, the philosopher, described by Rudinger. In each of these latter *savants*, who were remarkable for their dialectical and rhetorical ability, the convolution was more wavy and complex than in ordinary brains, this being especially marked at the base, but there was no reduplication at the upper extremity of the convolution, as in Gambetta's. In the present case there were other indications that the brain was not that of an ordinary person. The right quadrate lobe was very complicated, and divided into two parts by a furrow branching off from the occipital fissure. Of these two parts, the inferior was divided into several little convolutions by a furrow with numerous stellate branches.

The occipital lobe was very small, especially on the right side. Altogether the brain had a peculiarly fine appearance, due to its great and somewhat diagrammatic regularity, especially in the frontal region.—*Lancet.*

Oiling Wood.

Wagon makers or repairers can save their stock from worms by oiling with linseed oil. Single trees, double trees, neck yokes, spokes, and cross bars that are of white hickory, and are kept in stock for a year or more, will be eaten by worms if not kept in a dark place or otherwise protected. Coal and kerosene oil are good also, and the expense of applying is but little. Linseed oil is preferable, as it acts to some extent as a wood filler, filling the pores, and thus aiding the painting which follows in its proper place. Some manufacturers oil all their white hickory stock before shipping.—*Lumber World.*

THE famous South Metropolitan Station gas holder, of London, 214 feet in diameter, over 150 feet high, and 5,500,000 cubic feet capacity, long held its position as the largest in the world. It has now been eclipsed by a pair of holders erected recently at the Birmingham (Eng). Corporation Gas Works. Each of these is contained in a tank 240 feet in diameter, is said to be 150 feet high, and to hold 6,400,000 cubic feet.

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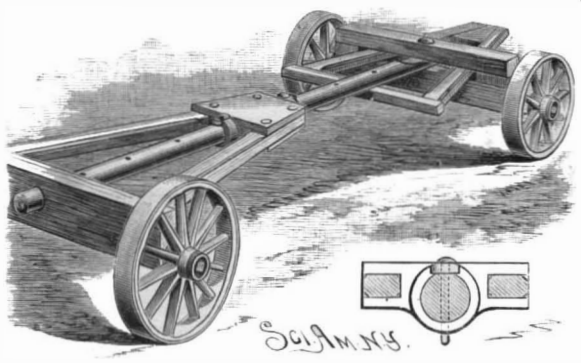
WAGON COUPLING.

This coupling, for connecting the front and rear ends of a wagon, is the invention of Mr. B. L. Farquhar, of Gratis, O. To the forward ends of the bars of the rear hound is secured a casting formed with side recesses to receive the hound bars. The reach is of cylindrical form, and is received in the sleeve on the casting and extended through a round hole in the rear bolster. The forward flattened end of the reach is secured by the king bolt in the usual way. The reach is prevented from moving in either direction through the sleeve by two rings held by pins passing through holes in the reach. A series of holes in the reach permits of changing the position of the rings to lengthen or shorten the wagon. As the reach is

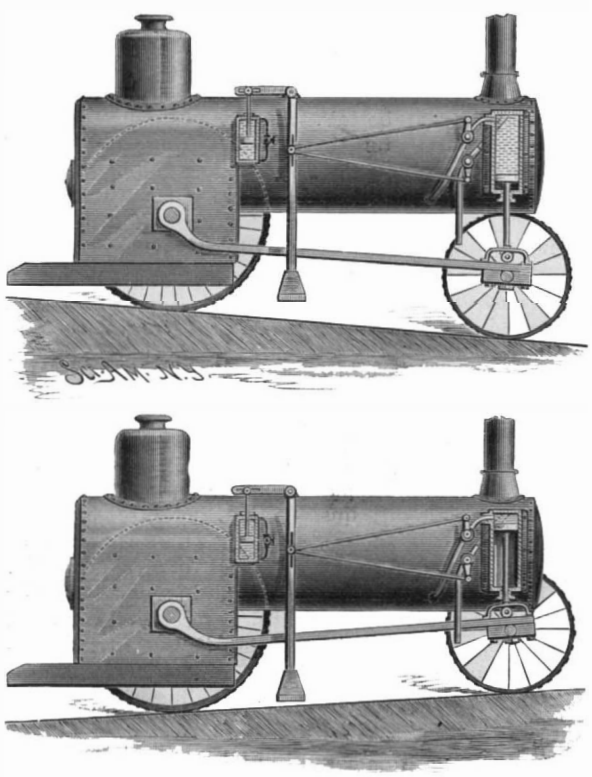


FARQUHAR'S WAGON COUPLING.

free to turn in the sleeve, it is evident that in passing over an uneven road, either the forward or rear axle may be inclined at any angle without straining the reach, or the rear hound, or the king bolt; and in case of the wagon turning over, this construction avoids breakage by allowing the reach to turn freely and independently of its attachment to the rear part of the wagon.

LEVELING APPARATUS FOR STEAM BOILERS.

This apparatus for automatically keeping steam boilers in a level position is designed particularly for use on road locomotives or traction engines. One end of the boiler is provided with one or two cylinders; the lower end of the piston rod carries a roller resting on a guide attached to the bolster of the truck of the boiler. The front end of the boiler is thereby supported on the fixed piston. The upper end of the cylinder, above the piston, is connected by a pipe with the water compartment of the boiler, while a pipe from the same end opens into the air or may lead to a pump connected with the boiler. Each of these pipes is provided with a valve, and these valves are operated by rods leading to a pendulum suspended from the top of the boiler. When the boiler is in a horizontal position, both valves are closed and the piston is in the middle of the cylinder. When the truck passes down an incline, as shown in the upper view, the pendulum assumes an inclined position to the center line of the boiler, and the upper valve is opened to admit water



KRAMER'S LEVELING APPARATUS FOR STEAM BOILERS.

under pressure from the boiler into the top of the cylinder, thereby forcing the front end of the boiler upward until the pendulum and boiler are again in a normal position, when the valve is closed.

When the truck again reaches a horizontal position, the pendulum swings and opens the lower valve, when the water is forced from the cylinder until the piston reaches its middle position. When the truck passes up an incline, the water escapes from the cylinder and the forward end of the boiler is lowered, as shown in the lower view. A rigid arm extends from the upper end of the pendulum to a piston rod working in a cylinder filled with oil; the upper and lower ends of this cylinder are joined by a pipe provided with a valve. The speed of this piston, when changing its position, and consequently of the pendulum, is regulated by the flow of oil through the pipe. When the valve is closed the pendulum remains stationary. The use of this device, by keeping the boiler constantly level, will prevent the flues from burning.

This invention has been patented by Mr. John M. Kramer, of Maria Stein, Ohio.

Don't Undervalue the Boy.

The following sound reasoning we find in the *American Agriculturist.* It would be a benefit to both fathers and their sons if its precepts were more often regarded.

Too many men make their boys feel that they are of little or no account while they are boys. Lay a responsibility on a boy, and he will meet it in a manful spirit. On no account ignore their disposition to investigate. Help them to understand things. Encourage them to know what they are about. We are too apt to treat a boy's seeking after knowledge as mere idle curiosity. "Don't ask questions" is poor advice to boys. If you do not explain puzzling things to them, you oblige them to make many experiments before they find out; and though experimental knowledge is best in one sense, in another it is not, for that which can be explained clearly does not need experimenting with. If the principle involved is understood, there is no further trouble, and the boy can go ahead intelligently

Do not wait for the boy to grow up before you begin to treat him as an equal. A proper amount of confidence, and words of encouragement and advice, and giving him to understand that you trust him in many ways, helps to make a man of him long before he is a man in either stature or years.

The Boston *Journal of Commerce* also makes a good suggestion to parents apropos to the above.

Give him tools, says the writer, and let him find out for himself whether he has got any mechanical taste or not. Do not discourage him, as parents are apt to do, by saying: "Oh, it is no use for you to try to do anything with tools. I never have any taste that way, and of course you have not." If a boy finds he can make a few articles with his hand, it tends to make him rely on himself. And the planning that is necessary for the execution of the work is a discipline and an education of great value to him. The future welfare and happiness of the boy depends on the surroundings of his youth. When he arrives at that period in his life when he is obliged to choose what profession or what line of business to follow, it is highly important that he should take no false step. And if in his youth he has cultivated a taste for any particular branch, the choice of a profession or business will be made more easy.

George Westinghouse.

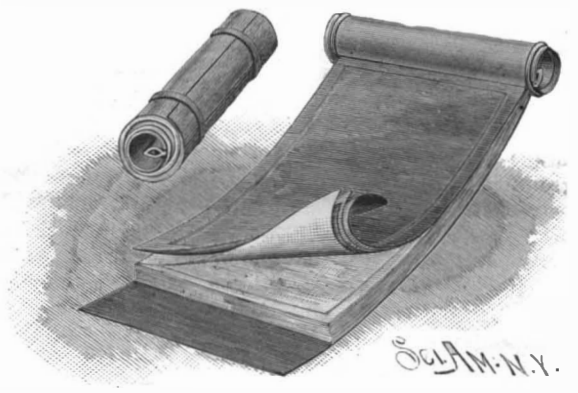
George Westinghouse owes his great and rapidly increasing wealth to his inventive genius. Twenty years ago he was a poor young man, but he struck it rich in his air brake for railroads, and money has since flowed into his coffers in a golden stream. He is one of the most prolific inventors of the age, and has enough good mechanical ideas to furnish every manufacturing establishment in Pittsburg with successful specialties. He is not only highly skilled in theoretical and practical mechanics, but is also a thorough electrician. He expends an ordinary fortune every year in experiments necessary to the perfection of his inventions. By warrant of the King of Belgium he is entitled to the title of Sir George Westinghouse, having been knighted by that monarch as a recognition of his services to the world as an inventor. He is a native of New York State, and is about 40 years old.—*N. Y. Sun.*

A Saw without Teeth.

A saw without teeth, that will cut a steel rail in two minutes, is in operation at the Central-Hudson shops, in Greenbush, N. Y. The saw is run by a ninety horse power engine, more power than is required to run all the other machinery in the shops, and is 38 inches in diameter, and three-eighths of an inch thick at the edge. The disk is made of Bessemer steel, and runs at a very high rate of speed. While in operation a band of fire encircles the saw, and the many sparks flying from the revolving disk resemble a display of pyrotechnics. To keep the saw cool and prevent it from cracking, a tank of water is placed above the machine, from which a small stream runs down and drops on the saw while in motion. By this plan one saw will cut nearly 3,000 rails before it is worn out. A steel rail, after about six years' constant use, becomes battered at the ends, and by cutting them off the rails can be used in branch and switch tracks. Rails are cut by this machine for the whole line of the Central-Hudson Railroad. The saw, while cutting, bears down hard on the rail, the end of which is left as smooth as the bottom of a flatiron. One remarkable thing about the machine is that the chips cut from the rail fly back under the saw with such force as to form a solid piece of steel nearly as firm as the rail itself.

COPYING PRESS.

The engraving shows, both folded and opened, a simple, inexpensive, and portable press for copying letters. The back of the copying book is inserted in a slot extending the entire length of a cylinder made of



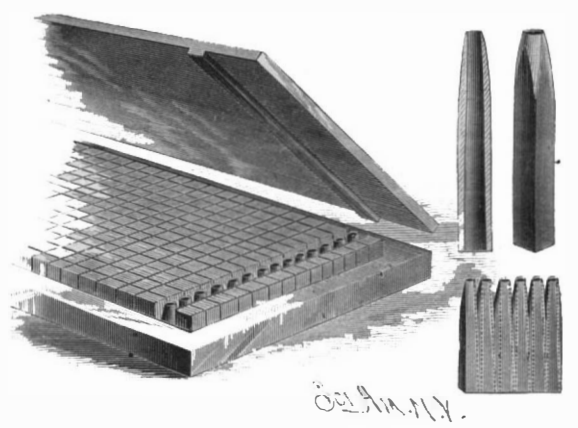
HAINES' COPYING PRESS.

sheet spring metal. The ends of the cylinder are hemmed and formed with creases for receiving elastic bands, which retain the back of the book in place in the slot. The book is formed of leaves folded around a triangular rod and stitched so as to inclose the wood, and is provided with a covering of suitable material, which covers the edges of the leaves when the book is wrapped around the cylinder. The leaves are made of tissue paper, and are prepared for receiving the copy by moistening them. The letter to be copied is placed in the book, a leaf is spread over it, and upon the back of the leaf is laid a moist cloth, when the book is closed and rolled tightly around the cylinder. Then two or three strong elastic bands are stretched over the book. The cylinder, by its elasticity, expands, thereby maintaining between the cylinder and bands a constant pressure upon the book. In two or three minutes the bands can be removed, the book unrolled, and the letter taken out.

This copying press is the invention of Mr. E. M. Haines, and is manufactured by the Haines Copying Press Co., of Dayton, O.

PERFORATING TYPE AND OVERLAY.

The object of this invention, which has been lately patented by Mr. Julius Mayerhoff, of Carthage, Mo., is to provide a device which, while much cheaper than others now in use, produces at the same time a perforation much sharper and neater than can otherwise be attained, and by the use of the overlay in conjunction with the perforating type to avoid cutting and injuring the rollers. The steel perforating type is equal in size to a nonpareil capital letter M, and is made in single type or in sets of any desired number, as shown in the right of the engraving. By making the faces of these types flush with the rest of the form, the inking roller will pass over them without obstruction or injury. By making the perforating type slightly shorter than the ordinary type, and making the overlay project correspondingly beyond the face of the tympan, the further advantage of avoiding both roller and ink is gained. As the type is formed with a tapering bore, increasing from the face toward the base, the little pieces of paper cut out pass down



MAYERHOFF'S PERFORATING TYPE AND OVERLAY.

freely, and no clogging is possible; when the type becomes filled, the form is raised and the accumulated pieces removed. A strip of soft lead, as shown in the large view, is attached to the tympan or cylinder of a press in such position as to meet the perforating type when the press is working, thereby obtaining a clean, sharp perforation, and both printing and perforating by one and the same operation.

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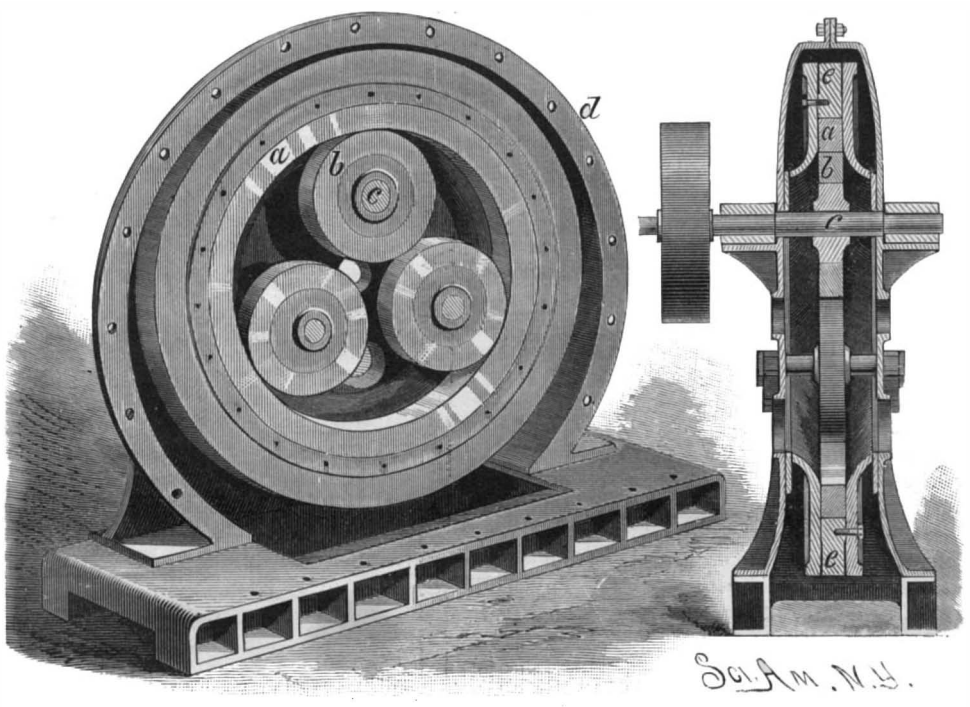
AN IMPROVED PULVERIZER.

The engraving shows a machine for pulverizing ores and similar substances, which is simple in construction, strong, and durable. Within the casing, *d*, is a steel lined ring, *a*, within which are placed three wheels provided with steel tires, *b*, and arranged in a triangle, as shown. These wheels or rolls are mounted on shafts in bearings in the case; the bearings of the two lower rolls are free to move in vertical slots in the case, so that their weight is carried by the ring which rests upon the upper roll, whose shaft is extended to receive the driving pulley, as shown in the sectional view. The revolution of the wheel, *b*, turns, by friction, the heavy ring resting upon it, while the ring revolves the two lower wheels. The ore to be ground is introduced into the space between these wheels, and is carried up by centrifugal force and crushed between the steel tires of the wheels and the steel lining of the ring. There is no slip between the rolls and the ring, and the material is crushed by the weight or pressure of ring on the upper roll and the weight of the lower rolls on the ring. The pulverized material passes out through the small slit-like openings, *e*. The machine is not liable to get out of order, and will pulverize a large quantity, introduced either wet or dry, in a comparatively short time.

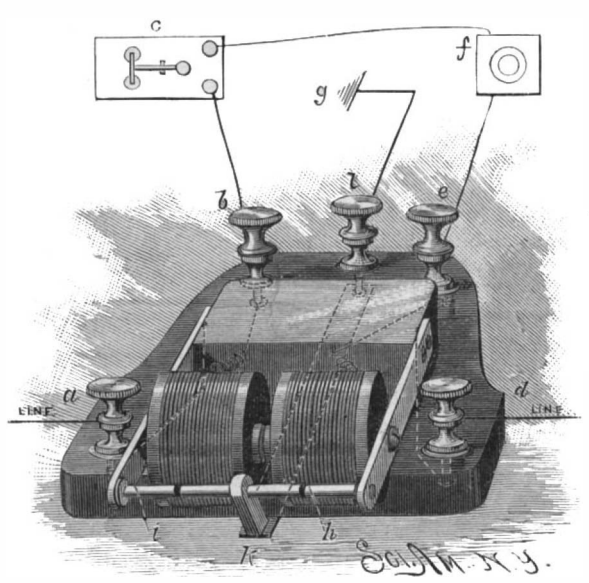
This machine is the invention of Mr. William H. Howland, whose address is Room 25, No. 39 Broadway, New York city.



HOWLAND'S IMPROVED PULVERIZER.

AN AUTOMATIC CUT-OUT AND LIGHTNING ARRESTER.

The illustration shows a simple arrangement for a device calculated for use in telegraph, telephone, and other stations where electrical line instruments are used, one intended not to interfere with the ordinary working of the line, but which will ground the line when the electric current is so greatly increased as to abnormally charge the apparatus, as sometimes happens during thunder storms. The apparatus is mounted on a block, in the center of which is a smaller block, from which project two metallic spring arms that support two electro-magnets wound with coarse, heavy wire, their pole pieces in the center closely approaching, but not in contact with each other. The spring arms project beyond the magnets, and at their ends carry contact points, *h i*, which project inward toward a central standard, *k*, which carries contacts in line and arranged to co-operate with the contacts, *h i*. The standard, *k*, is in electric connection with the ground at *g* through the binding post, *l*. The line wire leads to the binding post, *a*, thence through the spring arm and magnet to the binding post, *b*, to the line instruments at the station, *c f*, back to the binding post, *e*, through the coils of the other magnet to the post, *d*, and on to the line. The magnets, being made of heavy, coarse wire, will not be appreciably affected by an ordinary current, but when they become heavily charged, will so attract each other that the contact points, *h i*, are brought into electric connection with the contacts that extend from the central standard, *k*, thereby grounding the line.



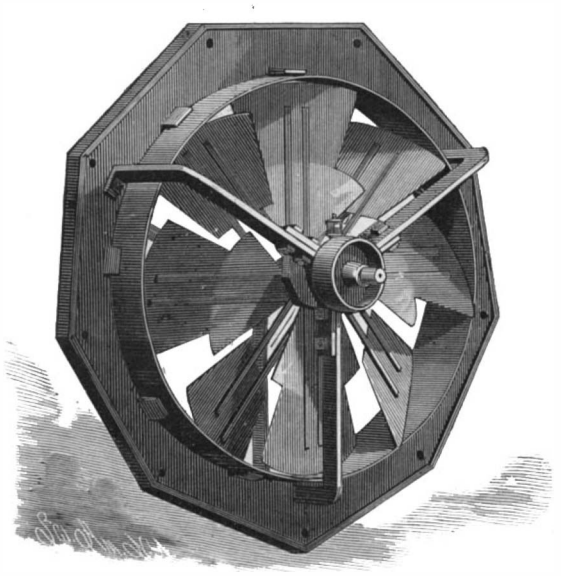
BELT'S CUT-OUT AND LIGHTNING ARRESTER.

This invention has been patented by Mr. Perley P. Belt, of Columbus, Kansas.

SUNFLOWERS are used in Wyoming Territory for fuel. The stalks when dry are as hard as maplewood and make a hot fire, and the seed heads with the seeds in are said to burn better than the best hard coal. An acre of sunflowers will furnish fuel for one stove a year.

IMPROVED ROTARY VENTILATOR.

This invention particularly relates to rotary ventilators for ejecting foul air from apartments or buildings. The bearings for the shaft of the wheel are carried by frames secured by bolts to the front and back of the face plate. The meeting ends of the frames are bent to form a triangular central opening for receiving the bearings, and to provide for uniting the bars together by bolts. The vanes of the ventilating wheel are of special and peculiar construction. Half of the vanes—alternating with the others—are of arc shape, and are only made to extend partly along their arms from the perimeter of the wheel, thereby, so far as they are concerned, leaving a large central opening through the wheel outside of the hub. This opening is, however, mainly covered by the inner portions of the intermediate vanes, the outer portions of which correspond with the others. These inner portions are made much wider than the outer ones and are considerably extended on both sides, so as to slightly overlap each other. This construction, makes the inner part of the wheel much more effective than in wheels of the usual construction, and leaves an ample space between the several vanes for the passage of the air between them. This is also a valuable feature when it is desired to move air against a pressure, as it prevents the air from slipping back through the central opening. The arms carrying the vanes are tangentially, instead of being radially, arranged relatively to the center of the wheel.



BRIGGS' IMPROVED ROTARY VENTILATOR

In a wheel for blast purposes the arrangement of the blades would be somewhat modified. The outer and inner number of blades would be reversed, and the inner blades would be lapped very much to prevent any return of the air. The angle of the blade would be made to suit the work in each particular case.

This invention has been patented by Mr. Edwin F. Briggs, of 1221 De Kalb Avenue, Brooklyn, N. Y.

PEACH ROOT TEA is a remedy for epilepsy, according to Dr. J. L. Dorset, of Dorset, Va. (*Medical Age.*) Three or four ounces of an infusion are to be given daily. Dr. Dorset reports one case in confirmation of his view.

A Use for Fire Damp.

The distressing explosions which occur from time to time in European coal mines, and less frequently in those of America, are in some cases the result of finely divided dust suspended in the atmosphere of the collieries, but for the most part they must be attributed to the presence of marsh gas, the dreaded "fire damp" of the miners. When this hydrocarbon is mixed with air, it forms a highly explosive compound. In the fiery coal pits of England the gas is one of the most serious obstacles to mining operations. It is, however, an excellent fuel, and forms almost the sole constituent of the natural gas issuing from many of the Pennsylvania wells. The proposition has therefore been made, and we believe the actual experiment is now in progress, to drill six inch bore holes down through the coal measures and thus afford an outlet for the gas reservoirs.

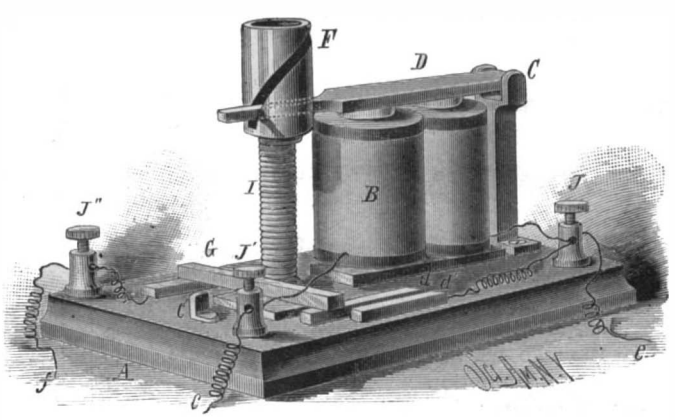
The fluid, if found in sufficient quantities, could then be used as a fuel, while the mines at the same time would be relieved of a very undesirable tenant. The coal mines of western Pennsylvania are fairly free from fire damp, the gas being largely stored in the porous Devonian sandstones which lie above the coal measures. Local conditions have, however, dictated a different disposition of the gas in the geology of England. The coal seams themselves are its depositories. Instead, therefore, of possessing an economic value, it is, under the present arrangement, a constant menace to those engaged in winning the coal. It is hardly probably that these borings would have a sufficient output to make their value comparable with that of American gas wells, but the proposition is well worth considering, if for no other reason than the possibility of lessening the fatality among the miners.

Instrument for Reproducing at Will an Invariable Quantity of Electricity.

The instrument is a voltameter hermetically sealed and thus rendered independent of barometric, hygrometric, etc., fluctuations. The water decomposed by the current during each operation can be reconstituted afterward by passing a spark between two wires sealed in the upper part of the tube.—*Marcel Deprez.*

LIGHTNING ARRESTER AND AUTOMATIC CUT-OUT.

A recent invention to afford an improved lightning arrester and automatic cut-out for dynamo-electric machines is shown in the accompanying illustration. When the current is working normally on the circuit, the armature, D, is drawn down to the bottom of the cam, F, turning the sleeve in opposition to the tension of the spring, I, and bringing the bar, G, into contact with the bar, *d*, of the lightning arrester. The line wire, *e*, is connected with the binding posts, J and J′, these posts being connected with the terminals of the magnet, B; and when the line wire is struck by lightning, the current, in passing from *d′* to *d*, to reach the ground through the bar, G, and ground wire, *f*, forms an arc between *d′* and *d*, when the dynamo current will continue to pass the space between the base of the lightning arrester to the ground for an instant, and the diversion of the current allows the magnet to become demagnetized, thus releasing the armature, D, and removing the bar, G, from the bar, *d*, when the arc will be broken and the dynamo current follow its original path. This device also indicates, by its momentary action, if the lightning arrester is clogged with dust or any conductive material, so as to short-circuit the dynamo and send the current to the ground instead of over the line. This invention has been patented by Mr. John Horen, of Omaha, Neb., and the device is being manufactured by Mr. John Brannan, of 439 Lawrence Street, Denver, Colorado.



HOREN'S LIGHTNING ARRESTER.

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The "Remington-Lee" Magazine Rifle.

Major Armstrong, late A. P. D., gave a description of this rifle at the English Royal United Service Institution, March 26. In the course of his remarks, he said that the best of soldiers are naturally inclined in the excitement of action to fire away their ammunition fast; and notwithstanding the strictest orders to keep the magazine in reserve, and use the arm as a single loader, until the occasion arose for a rapid and concentrated fire, the majority in any body of men would be pretty sure to draw on their magazines as long as there was a shot in the locker. An officer then could not possibly know whether his men really had magazine arms in their hands or not, unless he examined each arm separately, emptying from it and replacing all the cartridges.

Several attempts have been made to adopt a repeating or "quick firing" attachment to the ordinary breech loader, so as to convert it for the moment into a repeater, but they all leave much to be desired as regards strength, handiness, sightliness, quickness of action, and, above all, rapidity of adjustment and replacement; with none of them can the result be considered really a magazine rifle. "It is," said the lecturer, "in this direction that inquiry and experiment are naturally tending more and more, and I think there can be little doubt the arm of the future will be the best single loader obtainable, plus a good attachable magazine system. I think you will find that practically that ideal has been attained, as regards the latter half at any rate, in the 'Remington-Lee' rifle, invented and patented by Mr. Lee, and made by Messrs. E. Remington & Sons, of New York.

"It is at this moment a simple breech loading rifle, with bolt action differing little from other bolt systems except that it is simpler and stronger than most. This particular model is of 0·45 caliber, rifled with five grooves, taking a complete turn in 20 inches; weight about 9 pounds; and takes the United States Service cartridge of 70 grains of powder with a bullet of 405 grains, giving an initial velocity of about 1,350 feet per second. And the action is particularly quick and easy. The details given can, of course, be varied to any extent desired in the manufacture; the important feature is the independent magazine system. The arm can be used indefinitely in its present form as a single loader, until the necessity arises for the quickest and most concentrated fire obtainable, when it is converted in a moment, at the word of command, into an almost inexhaustible repeater of the most rapid action.

"Any desired quantity of reserve ammunition can be served out in the magazines, each containing five cartridges in no greater space than if they were in the ordinary paper packages. They are made of sheet steel in one piece, with a simple spring to propel and a 'carrier' to guide the cartridges—three pieces in all. They are specially contrived to combine the maximum of strength and efficiency with the minimum of cost, though, if retained, they can be recharged and used hundreds of times. The cartridges are stowed away in them in a moment, and yet are so firmly held that it is scarcely possible to displace them unintentionally, even with the roughest treatment; while the empty magazine is removed and replaced by a full one in less time than is required to insert a single cartridge in the ordinary single loader. This quickness of adjustment is a very important feature, for though the capacity of each magazine is small, it it so easily and speedily replaced that the magazine system is practically inexhaustible, being really limited only by the carrying power of the soldier.

"The rifle has been fired from the shoulder, as a repeater, fifty times in one minute, during an official trial in America, a rate much beyond that of any other magazine arm. The magazine in use offers no inconvenient projection nor unsightly feature, while its weight is so disposed that the center of gravity of the rifle is never disturbed, the balance of the arm remaining therefore always the same; and the cartridges lie always side by side in the magazine, where they are really better protected from all possibility of accident than they could be anywhere else. It is evident that the officer can see at a glance, even from a considerable distance, whether the arm is being used as a single loader in obedience to orders, or if any of his men has brought his magazines into play before the word of command. The charged magazines, moreover, would be carried apart from the loose ammunition until required, in separate pouches, so that to make use of them would involve a distinct and explicit drill motion."

WALLS laid up of good, hard-burned bricks, in mortar composed of good lime and sharp sand, will resist a pressure of 150 pounds per square inch, or 216,000 pounds per square foot, at which figures it would require 1,600 feet high of 12 inch wall to crush the bottom courses, allowing 135 pounds as the weight of each cubic foot. Walls laid up in same quality of brick and mortar, with one-third Portland cement added, will resist 2,500 pounds per square inch, or 360,000 pounds per square foot, which would require a height of wall of 2,700 feet to crush the bottom bricks.

THE DEEPEST FOUNDATION IN THE WORLD.

(*Continued from first page.*)

The location of the bridge is one that demanded extraordinary work, not in regard to the superstructure, but in relation to the foundations for the piers. The bed of the river is made up of mud and soft sand, hard gravel being reached at a depth of 185 feet below high water, and as the rails are to be 42 feet above high water the total height from the bottom of the piers to the rails will be 227 feet. Sinking piers to such a great depth has never been attempted, even in this age of wonderful engineering, and on this account principally the methods to be pursued have attracted much attention both in this country and Europe. The following description of how the work is to be done will, therefore, prove to be of interest.

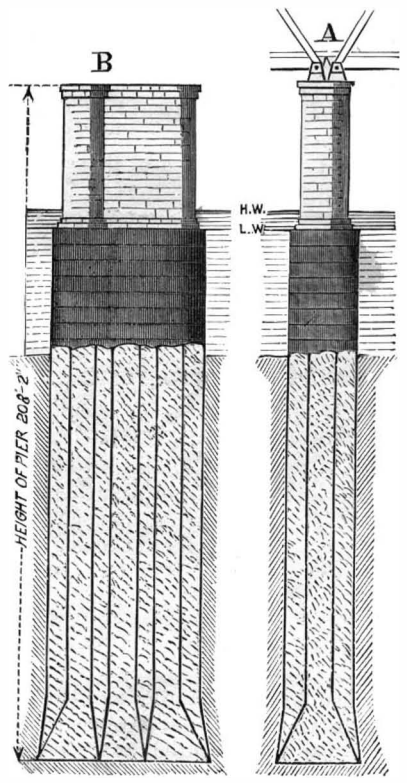

Fig. 3.—SECTIONAL ELEVATION OF PIER.

Like most of the methods of American engineers when called upon to perform an unprecedented work of great difficulty, the chief characteristic of these plans, as now contemplated, is simplicity. The principle governing this undertaking can be readily illustrated by any one. Take two pasteboard tubes, one about one-half the diameter of the other, and arrange them concentrically with the lower edge of the small one a short distance above the lower edge of the large one, and then join the lower edges of both tubes with a piece of pasteboard. This will form a thick cylinder, having a central opening, flaring at the bottom. If this be inserted, flaring end down, in a bucket filled two-thirds with sand and full of water, it will be found to be next to impossible to push the cylinder to the bottom of the bucket; but if the annular space between the two tubes be filled with sand, and then the sand be scooped out from the inside of the little tube, the cylinder will gradually sink to the bottom of its own accord. This is precisely what will be done in sinking the foundations for the Australian bridge, and what was done in sinking the foundations, to a depth of 125 feet, of the Atchafalaya bridge on the Texas and Pacific Railroad, three years ago.

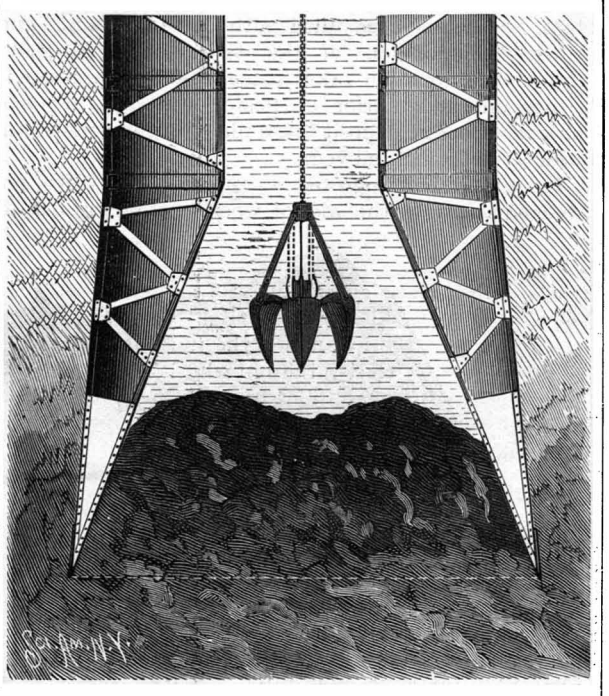

Fig. 4.—ENLARGED VIEW OF BOTTOM OF PIER.

The outer tube in this instance is oblong in plan, being 20 feet wide by 48 feet long. It is made of boiler plate, three-eighths of an inch thick, and the edges of the several sections are brought together and riveted to a T-bar placed upon the interior, thus making the exterior perfectly smooth and free from offsets. At a point 20 feet from the bottom the tube begins to flare, and the lower edge is 2 feet larger all around than the upper portion. Upon the outside of the bottom is secured a steel plate or cutting shoe, 1 inch thick, 2 feet deep, and projecting 6 inches below the edge of the tube; the lower edge of the shoe is sharpened. Within the outer tube are placed, at equal distances apart, three cylinders or dredging tubes, 8 feet in diameter, made of one-quarter inch iron, and united in the same manner as the outer one. The lower part of these tubes is extended to meet the cutting edge, and the inner and outer tubes are rigidly united by a system of bracing, as shown in Fig. 4, which also represents the bucket to be used. The space between these tubes will be filled as the cylinder sinks with concrete mixed in the following proportion: 1 Portland cement, 2 sand, 3 gravel, and 4 broken stone. After the cylinder has reached a solid resting place, the three inner dredging tubes will also be filled with cement, thus making a pier of solid cement from the bottom to the water level. From low water up, the piers will be of cut stone masonry.

In the sectional elevation, Fig. 3, A is a view at right angles and B a view parallel with the axis of the bridge.

Mixing cement will be done by machinery placed upon a float anchored alongside of the pier. The mixer consists of a square box 16 feet long, provided at each end with an outer ring or collar, which rests upon rollers. A toothed wheel at the outer end meshes with a pinion driven by an engine. The revolution of this box thoroughly mixes the sand and cement, which are introduced through a curved chute leading from a hopper on a platform just above the box. The requisite quantity of water is admitted at the same time. The mixed cement falls from the outer end into buckets, which are carried by cranes where needed on the pier and dumped.

Upon the opposite side of the pier is moored a large float carrying two sets of hoisting machinery. The booms are so arranged that either dredge can be worked in the center or one of the end dredging tubes. Thus, by making one dredge take two loads from its own end tube and one from the middle tube, the amount of material excavated from each of the three tubes can be equalized.

During the sinking of the piers, it is not expected to encounter any formidable obstruction such as a large rock. Trunks of trees may be met, but their presence would not hinder the work in the least, since the great weight of the pier would force the cutting edge of the shoe through them. Tree trunks were met during the building of the Atchafalaya bridge, and in one case where the weight was insufficient to force the shoe through, that part of the log projecting into the tube was grappled and the log broken, when the pier was sunk without further trouble.

The contract price of the bridge is £327,000. The contract for sinking the piers has been let to Messrs. Anderson & Barr, of this city, who superintended the erection of the Atchafalaya bridge.

A Shetland Tirl.

A Dumfermline tourist, who visited Shetland last year, says the *Miller*, of London, England, has given a graphic description in one of the local papers of what he saw in the course of his tour. One of the things which came under his notice was one of the primitive grinding mills called the "tirl" mills of Shetland. He had seen numbers of these in a half ruinous condition in the more northern parts of the mainland, indicating that they were being superseded by some superior system. These "tirl" mills are very low erections, generally built in the side of a brea, down which a stream from some hidden hill loch finds its way. By a simple sluicing apparatus the stream is turned when wanted to run under the floor of the mill in a steep, sloping artificial channel. In this channel is placed an upright circular shaped piece of wood, having an iron spindle in the center. The lower end of the spindle is fixed in the channel, while the upper end finds its way through the floor of the mill and is attached by a cross piece to the upper millstone. The circular shaped piece of wood is fitted with six projecting boards, against which the water strikes as it rushes down its prepared course, and so sets the upper stone in motion. Through an opening in the center of this stone the corn is fed in by hand, and the meal, as it is ground, percolates from between the stones, and falls on a clean clay or boarded portion of the floor, from whence it is gathered. The stones are about thirty inches in diameter and from three to five inches thick. Grinding mills of a more modern type are now, however, established in several districts among the islands, and gradually the "tirl" is being replaced by the superior article. Still the "tirl," and even the quera, driven by hand, are found in use in various parts of both Shetland and Orkney.

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How Magenta is Made.

The London *Chemical Review* translates from Dingler's *Polytechnisches Journal* an article by P. Schoop on the arsenical process of manufacturing magenta, containing facts all the more interesting here, now that Americans are embarking in the anilin industry.

The melting pot used is of cast iron, 1·35 meters in diameter and 1 meter in height, set over a suitable furnace. The lid can be lifted, if need be, and pushed out of the way by means of a pulley and crane. The stirring apparatus is kept in action during the entire time of heating. A small aperture serves for taking out samples of the melt. The charge consists of:

Arsenic acid, 194° Tw	75 kilos.
Arsenic acid, 194° Tw. recovered, same sp. gr. as above.	300 "
Anilin for red.....	300 "
Liquid which has distilled over in former operations..	200 "

The firing up is so managed that the distillation begins in about seven hours, and that then 10 liters pass over every hour. After the lapse of twenty hours the heat is increased so that 20 liters may pass over hourly. When 400 liters have been distilled off, the melt will already have become thick, whereupon the fire is slackened. As soon as the contents of the pot become pasty they are scooped out, and the melt when cold is broken.

The distillate is mixed in a parting funnel with about 100 kilos salt, upon which the oil speedily separates. The salt solution is diazotized, precipitated with a solution of naphthol, and worked up into naphtholorange. More advantageously it is converted into saffranin.

The melt is ground up, wet to a fine, thin paste, in lots of 100 kilos, and passed through a filter press. The filtrate is evaporated in an iron steam pan for the recovery of the arsenic acid, while the press cake is again stirred up with lukewarm water and filtered once more. The filtrate from this serves for grinding up the next melt. The crude melt, after washing, is a yellowish-green powder, which is twice lixiviated in a suitable extraction kettle with boiling water. About a tenth part of the melt is treated in this kettle with 3,600 liters water and steam at a pressure of 1·5 to 2 atmospheres. After four hours the whole is passed through a filter press, and the residue again treated in a second kettle with 3,600 liters water in the same manner. This second decoction is run into the first kettle, which has in the mean time been charged again. The remainder, after this double extraction, forms one part of the poisonous, useless residues. The color decoction of one lot, after standing for half an hour and depositing certain impurities, is mixed hot with 200 kilos rock salt, whereupon, after heating, the muriate of the color separates out almost completely. In the liquid drawn off after standing for two days a little more color is thrown down by the occasional addition of a little milk of lime, and is worked up separately. The remaining lyes, containing much arsenic, are precipitated with lime, and this precipitate forms the second portion of the poisonous residue.

The precipitated crude magenta is purified by a systematic fractional precipitation. The crude magenta, forming one-fifth of the melt, is dissolved in a wooden cask in 1,000 liters water, boiling up by means of steam, and 40 liters of a 4 per cent solution of soda are gradually added. A greenish or golden resin separates out on the sides and on the surface. The liquid is then passed through a coarse filter into a wooden vat, and mixed with two liters muriatic acid to prevent the separation of chrysanilin and delay the crystallization of the magenta. Upon the liquid is laid a lid with wooden rods, which, as well as the sides and bottom, are in two days found covered with fine crystals. The mother-liquor is run off, the crystals are dried in the air and afterward in a drying room at 104° F. The yield is 20 kilos of crystals, while about 4 kilos magenta remain in the mother-liquor and 15 to 16 kilos resin are separated out. From the mother-liquor the color is precipitated by soda lye, and about 40 kilos of it are dissolved in muriatic acid. Here we proceed as in the purification of the crude magenta, about one-third of the coloring matter being separated out as a resin, and crystals of magenta being obtained on cooling. In this mother-liquor there remains very much chrysanilin. By precipitating with soda, and evaporating the colored mass with acetic acid, cinnamon brown is obtained.

The resin which separated on purifying the crude magenta (resin No. 1) is dissolved in muriatic acid. On boiling the said liquor a resin separates out, consisting chiefly of mauvanilin, an almost worthless substance. By soda a portion of magenta is again separated, and on cooling the filtrate a little more is obtained. The lye, after the separation of this portion of magenta, is mixed with resin No. 1. Resin No. 2, obtained by purifying resin No. 1, is again dissolved in muriatic acid and boiled, when some more mauvanilin is deposited and is removed. From the hot solution salt precipitates cerise. After filtration the color is washed, neutralized with muriatic acid, and evaporated down in iron pans heated by steam, yielding thus the cerise of commerce. In the filtrate from the precipitate of cerise, the magenta remaining in solution is precipitated with soda, and the base mixed with resin No. 2, whereupon a further purification of the lye-products is undertaken, yielding grenadin and maroon.

To test the magenta for the presence of chrysanilin, muriatic acid is added to the hot solution in water, and zinc powder is added in small portions until the red color disappears. If the magenta was free from chrysanilin, the solution will then be colorless. Otherwise, it is yellow.

Except for the manufacture of acid magenta, the magenta obtained according to the above process is used only in preparing common reddish rosanilin blues.

BALE AND BOX HOOK.

In the common form of box hooks the shank is fastened in the handle by being passed transversely through it and then riveted. A shank thus fastened is apt to become loosened and turn in the handle, while the fingers between which the shank is passed are liable to become chafed. With the hook herewith illustrated the fingers are passed through the

THE SAN JOSE BALE AND BOX HOOK.

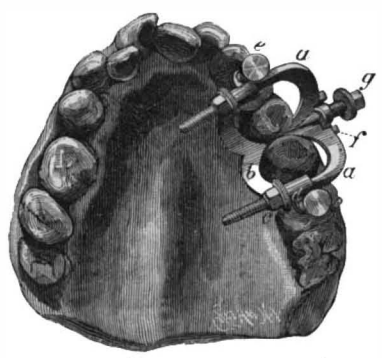
opening formed by the handle and the prongs of a fork formed on the upper end of the shank; the turning of the hook is prevented, and there is no wear between the fingers. To prevent the chafing of the outer sides of the fingers by their coming in contact with the box or bale, there is provided a leather guard, as shown in the upper view, or a metal frame, as shown in the lower view. The handle is slightly extended toward the front, thereby allowing a firmer grasp to be taken of it and a more easy and accurate guiding of the hook.

This invention has been patented by Mr. Philip J. Stockinger, of San Jose, Cal. These hooks can be seen at the San Jose Agricultural Works.

DEVICE FOR SEPARATING TEETH.

The separator of teeth invented by Dr. H. A. Parr, of New York city, is a continuous circular wedge, so constructed that teeth can be separated in a few minutes, with little pain, in most cases without any. When the arch is crowded, or the teeth are irregular, cavities form between them, by pressure and unnatural contact, and cannot be filled without separation; and when the position of the teeth is mechanically changed, absorption takes place when the pressure is either on the anterior or posterior surface, while a process of ossific deposit takes place in the space from which the tooth is moved.

In the system followed at present, the teeth are wedged apart by the aid of wood, cotton, rubber, or



PARR'S DEVICE FOR SEPARATING TEETH.

some such material, and often remain separated a number of days, causing pain to the patient and unnecessary labor to the operator. Frequently, the teeth have to be trained back to their former position. During the separation the ossific deposit formed has to be displaced, which in some cases it is difficult to do, and not unfrequently the teeth operated on remain separated for life. The herein described instrument was invented by Dr. Parr to do away with these difficulties.

The device may be adjusted to the centrals, bicuspids, and molars, and is particularly adapted for irregular teeth.

b represents an angular bar, tapered to a point, and terminating at each end in the sockets, *d*, through which pass the two semicircular bars, *a a*, the inner ends of which are tapered to a point and meet at an acute angle directly opposite to the angle of the bar, *b*. *a* and *b* may be brought together by turning the nuts, *c c*, which can be done with the fingers or with a wrench. In case the teeth have not been sufficiently separated by turning the nuts, *c c*, additional pressure may be brought to bear by means of the wedge, *g*, which may be used on the buccal or lingual surface. The vertical screws, *e e*, are for adjusting the instrument upon the teeth so as to prevent undue pressure upon the gums.

Rectangular Proportion.

W. Barnes.—Oblong rectangles are the forms of manifold planes in buildings and house gear—doors, windows, room sides, room floors, tables, boxes, bookcases, books, and pictures; and therefore it is worth while to learn whether there is a more or less comely form of rectangles, or of their outer frames. Of the square, which is a shapefast figure, and which, with the circle and equilateral triangle, makes a harmonic triad, there is no need that I should now discourse; but to many other cases of rectangular forms I think harmonic proportion may yield good effect. I like the effect which it has afforded in the framings of pictures. In the framing of a picture we have often found a third harmonic term to its length and breadth, and have then taken the whole, or a half, or a quarter of that third quantity for the width of the frame. On the taking of a half, the sum of the widths of the two sides, or two ends, makes up the third term of the triad, and on the taking of the quarter the third is found in the sum of the widths of the four frame sides.

If we would frame harmonically a print or drawing with a margin within the frame, we may get the width of both its frame and margin from a third harmonic dimension to the length and breadth of it, and then divide this third dimension into two parts, which shall be the latter two terms of a harmonic triad, of which the first is the whole dimension; and a square picture may be framed in harmony by taking for the harmonic triad (1) the width of the picture and two breadths of the frame; (2) the width of the picture; and (3) the twofold width of the frame.

I think that door frames, shutter frames, and the mantelings or frames of fireplaces may be often fitted for the better to the spaces they bound by harmonic proportions of widths; and though the lettering pieces of bound books are often set on their backs without symmetry either of width or place with the height of the book, yet, if the back of a book were divided into six spaces, and the lettering piece should take up the third from the top, it would be in harmony with the book's height both in place and measure, since the six spaces of the whole back and the three below and the two above the lettering piece would make a harmonic triad. So, again, I have reason to think well of the elevation of a church of which the heights of the tower, of the nave, and of the chancel are a harmonic triad, while another is made by the ground widths of the nave, of the chancel, and of the tower. It might be worth while also to try whether a steeple would not be graceful if, at three harmonic spaces of height, it diminished by a harmonic triad of widths, or whether a spiral line or a stream or path made to wind through a lawn would not be of graceful bends if at three harmonic spaces it went off from its axis by the measures of a harmonic triad of ordinates.—*The Architect.*

Expansion Produced by Amalgamation.

It has been accidentally observed by the authors that the amalgamation of brass is accompanied by great expansive force. If the edge of a straight, thick brass bar be amalgamated, it will be found that in a short time the bar is curved, the amalgamated edge being always convex, and the opposite concave. The authors imagine that a similar action may be the primary cause of the phenomena presented by the Japanese "magic mirrors." Japanese mirrors are made of bronze, and have a pattern cast upon the back, and although to the eye no trace of it can be discovered upon the polished reflecting surface, yet, when light is reflected by certain of these mirrors on to a screen, the pattern is distinctly visible in the luminous patch formed. In a paper before the Royal Society, they have shown that this is due to the polished side opposite the thinner parts of the coating being more convex than the others, a conclusion verified by the fact that the pattern is reversed when formed by a convergent beam of light. Such a condition of things would evidently result from a uniform expansive stress taking place over the reflecting surface, the thinner—and, consequently, the weaker—parts becoming more convex or less concave than the others. The authors have hitherto attributed this inequality of curvature to a mechanical distortion to which the mirrors are intentionally submitted during manufacture, to produce the general convexity of the polished surface; but they now think it possible that the use of a mercury amalgam in the process of polishing may have an effect in the production of this inequality of curvature.—*Profs. W. E. Ayrton and John Perry.*

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A Singular Poisoning Case.

The *Pharmaceutical Journal and Transactions* for March 27 gives an account of a singular instance of poisoning in Nottingham, whereby two children lost their lives and two others were made very ill. The deadly dose in this instance was an apparently harmless cough mixture containing the following four ingredients: Sirup of violets, sirup of squill, wine of ipecac, and oil of sweet almonds.

The symptoms that appeared in two or three of the children that had been taking this medicine were very singular, the pulse being intermittent. In the case of one of the children that died, there was an intermission of every third or fourth beat of the pulse. The heart's action was very much interfered with, there being an intermission of one in four or five beats. The pulses of the third and fourth children also intermitted, so that it was evident that there was some peculiar action in their hearts. In considering these symptoms, it seemed to the medical men that there were only one or two preparations which were likely to produce that action. One was a mixture of digitalis, or common foxglove, and the other the sirup of squill.

In order to ascertain whether the action was due to the latter, and the result not due to any accidental mixing or dispensing of the medicine, the coroner had the prescription made up by an independent chemist, and a second time by the chemist (Mr. Wakefield) who originally dispensed it. These prescriptions were placed in the hands of Dr. Truman, the public analyst, who injected samples therefrom under the skins of frogs. In the case of the mixture made by the independent chemist there was no slowing of the heart in an hour and three-quarters, when he killed the frog. In the case of the mixture made by Mr. Wakefield there was a total cessation of the heart's action in seventeen minutes. The mixture made by Mr. Wakefield was much more bitter than that made by the other chemist.

Dr. Truman, on considering which of the four ingredients of the mixture was most likely to contain the poison, came to the conclusion that it must be either the ipecac or the squill. The wine of ipecac gave purely negative results in both cases. He then injected ten drops of the sirup of squill from an independent chemist into a frog, and that slowed the heart's action from twenty-four beats a minute to ten in two hours and a half, when he killed it.

The same amount of Mr. Wakefield's sirup of squill was injected in the same way, and it produced a slowing of the heart's action from twenty-eight beats a minute to fourteen in forty-four minutes, and a total cessation of the heart's action by death in two hours.

He afterward made another series of experiments, in which he took larger quanties of the sirup of squill, and he had quantities of it from two independent chemists as well as Mr. Wakefield's. He repeated the experiments in the same way. In the case of the first independent chemist there was no slowing of the heart's action in forty minutes. In the second case there was a slowing of from thirty-one to ten beats a minute in forty-seven minutes, and in Mr. Wakefield's case there was a slowing of from thirty-six beats to one beat per minute in thirty-eight minutes. That fact, Dr. Truman thought, showed that the active agent was present in the sirup of squill. Mr. Wakefield's sirup of squill was very much more bitter and of very much deeper yellow than the other sirups. Both his prescriptions contained very strong heart poison which agreed in its essential characteristics with digitalis. The squill is a bulb gathered in Russia and Germany. In a squill there is found a minute and innocuous proportion of an active principle producing the same effect as digitalis, the quantity of which may be exaggerated by difference of climate, difference in the period of gathering, and it is also present to a greater degree in the outer scales and in the recent bulbs than in the inner part of the dry bulb. The vinegar of squill from which Mr. Wakefield prepared his sirup was purchased from a wholesale druggist, and probably contained an unusually large amount of the active principle of the bulb. Sirup of squill is in very common use as a remedy for coughs, and as it has hitherto been looked upon as rather a harmless medicine, this is an interesting and unique case.

A COMBINED CRUSHER AND STAMP MILL.

It is rare that a new principle is applied in grinding machinery. The stamp, buhr-stone, and roll are the ancient and approved methods of rock reduction, and no successful machine has heretofore been constructed for rock grinding that has not adopted some form of these elementary machines. But in all old pulverizer the process of grinding is a mutual one, the mill as well as the rock being ground. The Sturtevant mill, here illustrated, is a departure from all old methods, and the results accomplished are so remarkable, and the plan of the machine so entirely novel, as to constitute a matter of unusual public interest.

The Sturtevant mill is a combined crusher and pulverizer, seizing rocks of a large size and compelling them to pulverize each other in a most rapid and remarkable manner.

Making the rock do its own crushing and pulverizing is the novel and principal feature of the machine illustrated by the accompanying engravings. It is apparent that if by means of any mechanical contrivance the rock could be made to act upon and disintegrate itself without being crushed or ground between the faces of metal pieces, the machine would be subjected to a minimum amount of wear. Such being the case, it would naturally follow that the power expended in doing a certain work would be greatly reduced, while the capacity, or quantity of rock crushed, would be greatly increased. These desirable results are accomplished by the Sturtevant mill, which, as will be seen from the following description and the cuts, is very simple in construction. And is so arranged that it reduces the hardest materials with scarcely any damage to itself.

The two cylindrical heads or cups are placed upon opposite sides of a case, into which they slightly project, facing each other, and are made to revolve in contrary directions. The rock is conveyed to the interior of the case (which is kept full) through an opening at the top, and is prevented from dropping below the heads by a cast iron screen. The rock is then immediately thrown out by centrifugal force from the two revolving cups, in opposite directions, and with such force that the rock from one cup, coming in collision with the rock thrown oppositely from the other cup, is broken and pulverized, and the grinding, which would otherwise be upon the mill, is transferred to the material, which is at once reduced to powder; in other words, the mill does not grind the substance, but simply provides the power that compels the rocks to crush themselves.

The cast iron screen, shown in Fig. 2, in which both revolving heads are drawn back, is composed of small sections which can be easilyreplaced whenever required. The wear upon this screen is slight, as it is always protected from the action of the rocks thrown from the heads by a cushion of interposing material formed by the rocks, which constantly fill the case and cover the screen. The crushed rock passes through this screen and falls into a bin. When necessary to reduce the rock to a greater fineness than the screen outlets al-

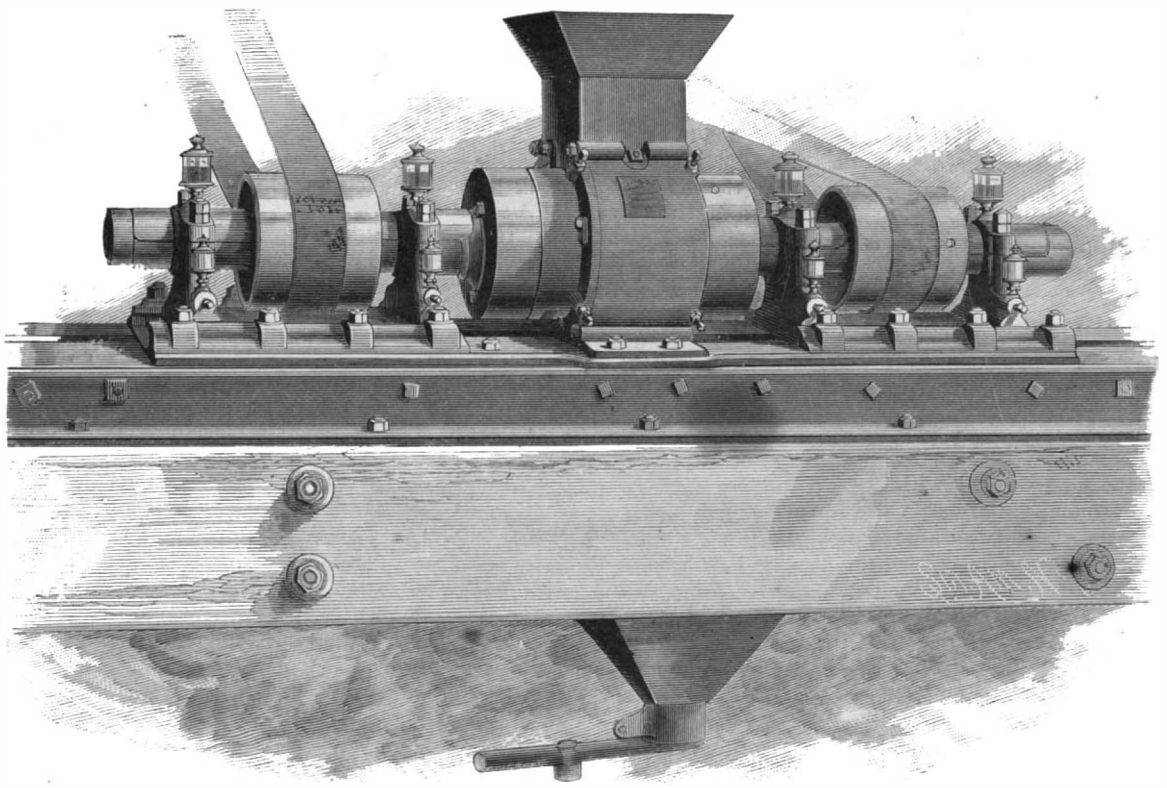

Fig. 1.—THE STURTEVANT COMBINED CRUSHER AND STAMP MILL.

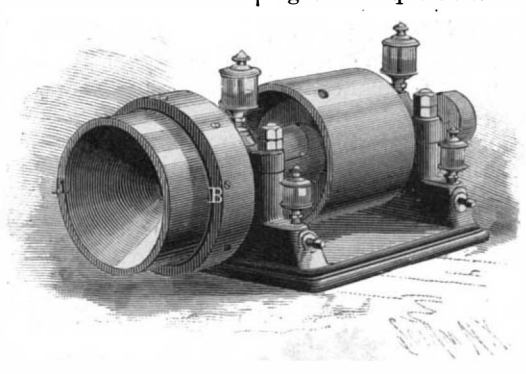

Fig. 3.—THE STURTEVANT MILL.—THE REVOLVING HEAD.

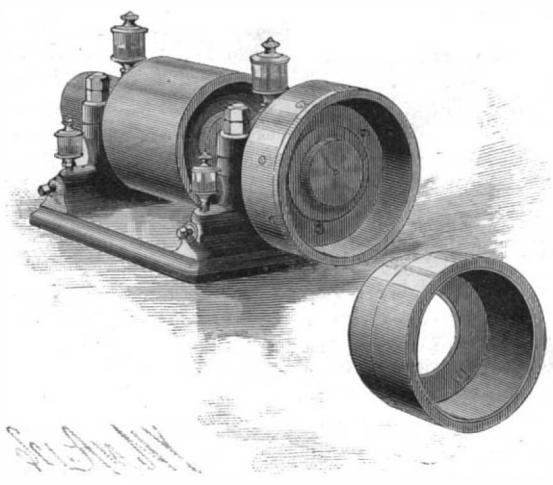

Fig. 4.—THE REVOLVING HEAD TAKEN APART.

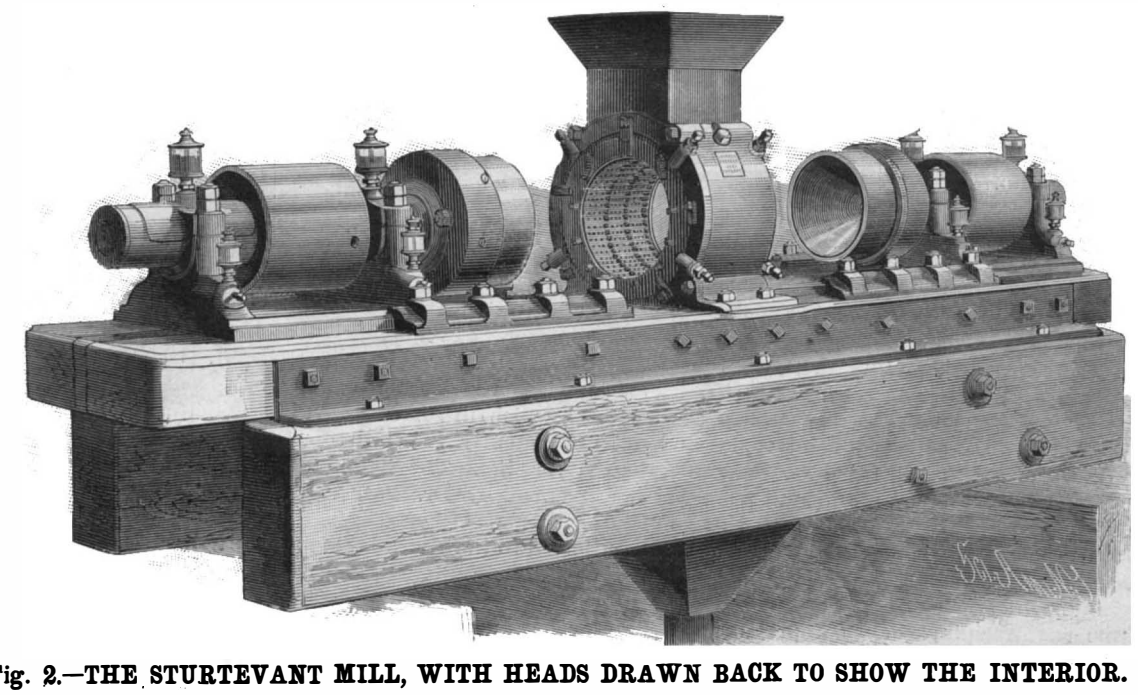

Fig. 2.—THE STURTEVANT MILL, WITH HEADS DRAWN BACK TO SHOW THE INTERIOR.

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low, the coarser part of what leaves the screen is reconveyed to the mill by an elevator for regrinding; that which is fine enough being first removed by the usual apparatus adopted in milling. A suction blower causes the air to draw strongly into the mill, thereby preventing the escape of dust.

The revolving heads, shown with the parts assembled in Fig. 3 and separated in Fig. 4, are each composed of two parts, one of which, A, a simple hard iron cylinder, called a bushing, is removable, and when worn can be easily taken out and replaced. As soon as the mill has been put in operation, a curious formation is made inside of the head of a conical, cup-like stone lining (Figs. 3 and 5), formed by the caking within the head of the material being ground. This lining is of the utmost importance, as it is a complete shield to these parts of the machine. With the exception of the edges of the bushings, the entire interior of the machine is completely protected from wear by the rock itself.

The elementary parts of the mill are clearly shown in Fig. 5. The end of each shaft carries a head holding a bushing that projects a little way into the case. Within each bushing is shown the hollow stone cone, formed by the packing of the rock. The hopper is filled with rocks that drop into the case between the heads. The arrows on the shafts indicate the direction of revolution of the two shafts. Immediately after starting, the stone cones form themselves, and become as hard as the rock itself. When these stone cones have been formed, it is apparent that the centrifugal force given by their revolution will hurl out all the rocks forced into them, in the general direction indicated by the arrows. The flying rocks are sure to collide with those moving in the opposite direction, as their journey is made through an atmosphere of the same material, for the mill is kept constantly filled. These collisions result in rapid and perfect crushing, and the rocks expend their force upon each other before reaching the iron work of the machine.

The iron screen is of very small diameter, and the ground rock is let out at once. This is a great economy, for to strike rock after it is once reduced to the fineness wanted is a serious waste of power, and, in metal-bearing rock, to leave a particle of free metal in a machine to be churned and pounded over and again many times, and worn away, would be often to suffer a great loss.

These mills are manufactured by the Sturtevant Mill Company, of 89 Mason Building, Boston, Mass. They are made in six sizes, with heads from 4 to 36 inches in diameter.

Some idea of their capacity may be obtained from the fact that the 20 inch mill will discharge from sixteen to twenty tons of hard rock per hour, and the 36 inch mill will reduce 1,500 tons of hard rock per day.

These giant grinders are of small size, and all of the power transmitted by the belts acts directly upon the rocks reducing each other.

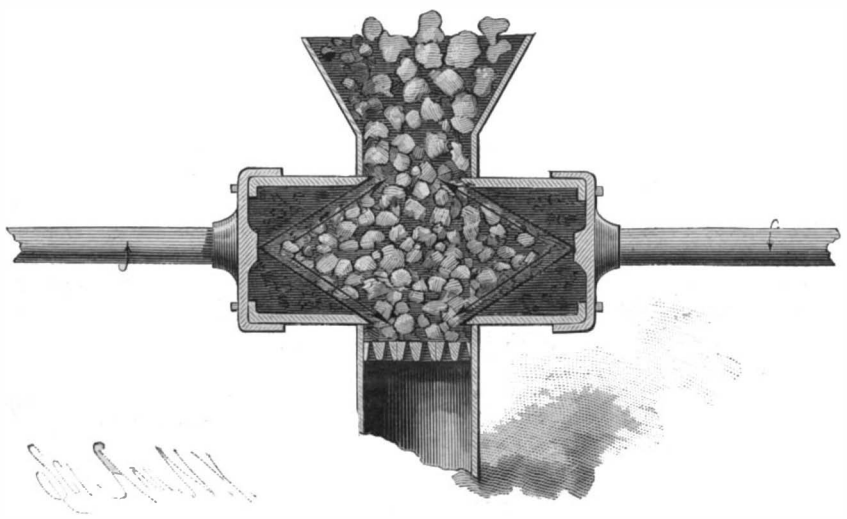
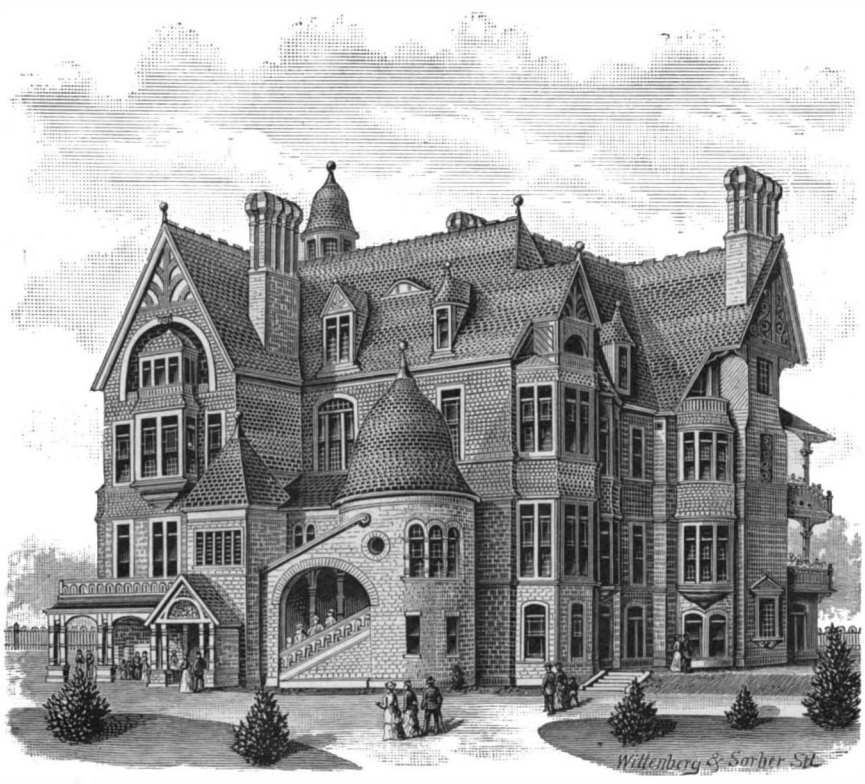


Fig. 5.—ELEMENTARY PARTS OF THE STURTEVANT MILL.

The Inventor of the Postage Stamp System.

Mr. Patrick Chalmers, of Wimbledon, has issued a pamphlet claiming that his father, James Chalmers, bookseller, Dundee, was the inventor, in the month of August, 1834, of the adhesive postage stamp. It appears that evidence has come to light, from papers bequeathed to the South Kensington Museum Library by the late Sir Henry Cole, of the original plan by James Chalmers of the adhesive postage stamp, to be printed from a die of various values, for use according to weight of letters, on sheets of paper specially prepared for the purpose and afterward gummed over with an adhesive substance, to be sold in sheets, in lesser quantities, or singly, as required, at post offices or by stationers—all as subsequently adopted by Mr. Rowland Hill, and in use to this day.

Mr. Chalmers makes out a case that is practically impregnable.



ST. LOUIS JOCKEY CLUB—SOUTHEAST VIEW OF CLUB HOUSE.

NEW CLUB HOUSE OF THE ST. LOUIS JOCKEY CLUB.*

The three illustrations herewith bring at once before the mind a good idea of the general plan and principal details of a new club house now being erected by the St. Louis Jockey Club, which it is expected will cost $50,000. Externally, the outline of the building, as presented in the view from the southeast, is broken into many projections—towers, gables, galleries, and porches being combined in such way as to present a most attractive appearance; but on the opposite side, that which looks toward the race course, there are to be two lines of galleries, 16 feet wide, running the entire length of the building, the ends shown at the right in the first engraving indicating their position.

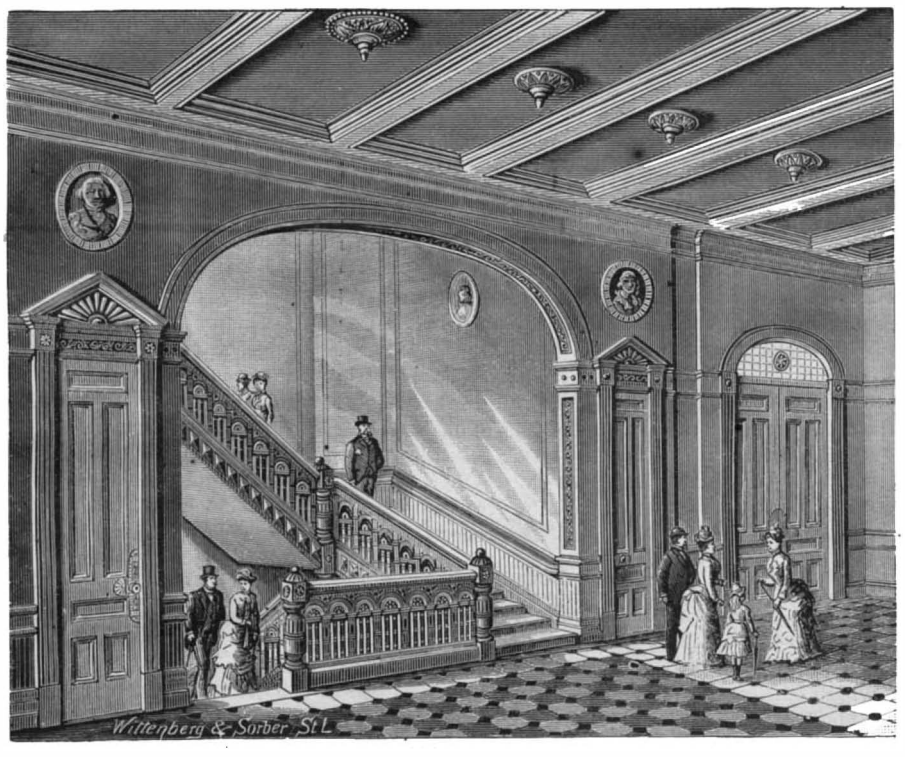
The second line of balcony and porch will have its floor stepped from the face of the porch back to the wall of the building, as with a grand stand, to give the occupants a better view of the races. The interior of the edifice will be handsomely finished and tastily furnished, after the designs shown in the engravings, for the use of members of the association and their families. Bowling alleys, a billiard room, and gymnasium are to be included in the arrangement.

The floors will be of polished yellow pine and the basement and first and second stories will be finished in hard wood. The walls of the ladies' reception room are rough cast and to be finished with gold bronze. The second story is to be devoted to private parlors and dining rooms. The main hall has the principal staircase recessed in it, inclosed by arches and lighted by a skylight.

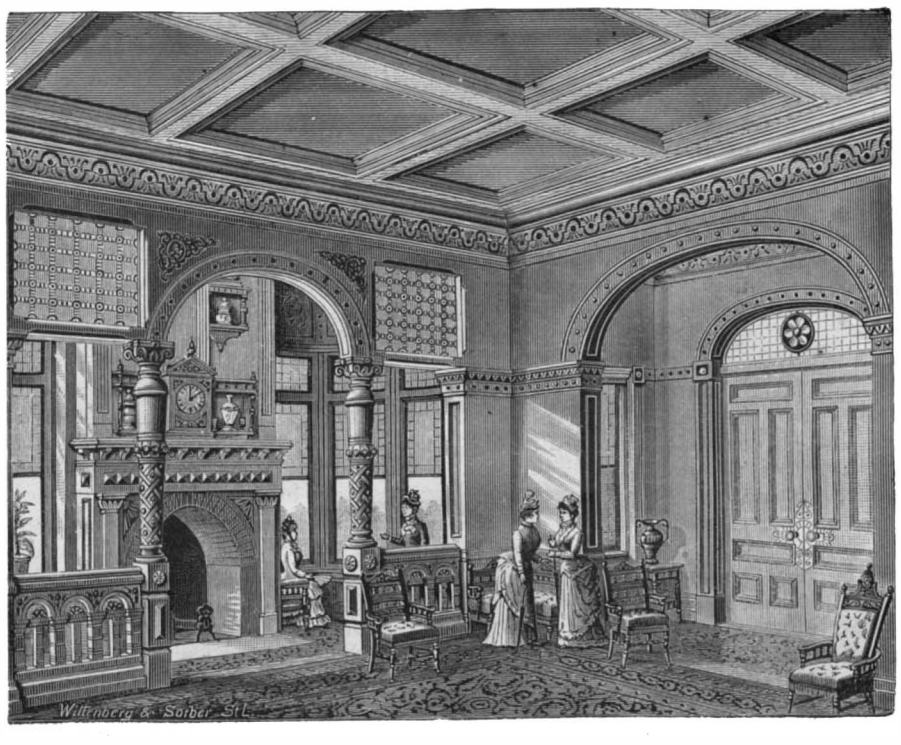
* We are indebted for our illustrations on this page to the *Illustrated Graphic News*, of Chicago, a recently established pictorial weekly newspaper, which presents many interesting features, and will obtain, without doubt, a large circulation in the West.

Manufacturers Must be on the Alert.

The manufacturer who hopes to hold his own in the fierce competition which characterizes modern industry must of necessity keep a sharp lookout for valuable improvements in machinery, and must introduce them promptly when they are presented. The movement of the industries is always forward. Thousands of ingenious minds are continually studying out methods for making processes easier and more economical. Every month some kind of a device for bettering the way of doing a thing, or for saving a little labor, is patented. The manufacturer who simply ignores these things and runs along heedlessly in the old way, with the old devices, will be left behind and beaten as surely as the earth rolls around the sun. A mill built and filled with machinery twenty years ago, and left unimproved, could not begin to compete with a modern mill containing all the new mechanical improvements. And the way to keep a mill property from deteriorating is to add in every important improvement as is it put on the market. The most successful mills are the mills that do this very thing; and they succeed because they do it.—*Textile Record.*



THE MAIN HALL AND STAIRWAY.



LADIES' PARLOR.

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A Cheap Concrete.

A kind of concrete made without cement is said to be coming into favor with Parisian architects. It is composed of 8 parts of sand, gravel, and pebbles, 1 part of burnt and powdered common earth, 1 part of pulverized clinkers and cinders, and 1½ parts of unslaked hydraulic lime. These materials are thoroughly incorporated while dry into a homogeneous mixture, which is then wetted up and well beaten. The result of this is a hard and solid mass, which sets almost immediately, becoming exceedingly strong after a few days. It may be made still stronger by the addition of a small proportion—say 1 part—of cement. Among other constructions to which this material has been appplied is named as an example a house 65 feet by 45 feet, three stories high, standing on a terrace which has a retaining wall 200 feet long and 20 feet high. Every part of this structure was made of the hard, economical concrete, including foundations, cellar vaulting, retaining wall, and all exterior and internal walls, together with their cornices, mouldings, string courses, balustrades, and parapets. No bond iron was used in the walls, and no wood lintels, beams, or posts were required. It is claimed for this material that it is not liable to crack or scale, and is extremely cheap, as it can be made almost wholly from materials to be found everywhere. Doubtless a further economy could be realized by employing simple machinery for mixing the materials in both the dry and wet stages.

Properties of Fluids and Solid Metals.

Professor W. C. Roberts-Austen, F.R.S., Chemist of the Mint, lectured recently at the Royal Institution upon "Certain Properties Common to Fluids and Solid Metals."

He began by drawing attention to the early memoir of Reaumur to the French Academy of Sciences on the ductility and malleability of metals, in which he clearly defined the conditions under which colloid metals would actually flow. The resemblances, said the speaker, between metals and fluids have long been known, and present the following eight prominent points: 1. Rejection of impurities on solidification. 2. Surfusion. 3. Flow under pressure. 4. Changes due to compression. 5. Absorption of gases. 6. Absorption of liquids. 7. Vaporization. 8. Surface tension.

In passing from the solid to the liquid state, the metals sometimes present the same phenomena as water; for instance, water distinctly rejects impurity to a considerable extent when it solidifies into ice; an alloy of lead, antimony, and copper on solidifying will reject much of the lead, and take up the remainder. Water may be cooled down to —8 degrees without actual solidification, but agitation then determines the immediate formation of ice, and the rising of the temperature of the mass to zero is indicated by a thermometer. Faraday stated that sulphur and phosphorus exhibit in their degree the same effects. The master of the Netherlands Mint has proved that gold and silver behave in just the same way. The lecturer here placed a small cup filled with molten gold upon the table in the dark; the metal cooled to dull red, scarcely visible, then at the moment of solidification flashed up brightly, and rose to the temperature of its solidifying point. Gold fuses at 1,020 degrees, but the slightest trace of silicon will lower the point at which it softens to the melting point of zinc.

In 1726 it was discovered by Louis Lemery that under certain conditions lead exhibits a remarkable property. It is common experience that a spurious silver coin has no "ring," and when a metal is not sonorous, the remark is sometimes made, "It is as dull as lead." In an ancient and perhaps now generally forgotten experiment, it was discovered that if lead be cast into the form of a segment of a sphere, that is to say, into the form of a plano-convex lens, it will emit quite a sharp note when struck. The speaker illustrated this by experiment, the lead giving a clear tinkling sound. A piece of lead beaten into the same shape with a hammer gave no ring when struck. It was true, he said, that the presence of a trace of impurity conduced to the sonorousness of the cast lead, but he would now strike a piece of chemically pure cast lead, and they would hear that it was sufficiently sonorous to illustrate his point. The conclusion in 1726 was that the phenomenon was due to the way in which the constituent grains of lead touch each other, also to their shape and size. In the recent discoveries on dilatation by Professor Osborne Reynolds, there seemed to be something of the same kind; in the case of the lead there was a true flow, and a passage of small particles of matter from one position to another under the hammer. A solid may be very brittle, and yet it will flow; a horizontal stick of sealing wax, supported only at its two ends, will in course of time bend at the normal temperature of the atmosphere, in which phenomenon there is a slow flow of particles; yet let an attempt be made to similarly bend the same stick of wax suddenly, it will snap. M. Tresca, of Paris, by bringing great pressure to bear upon disks of cold lead, forced the lead to flow through a small hole, from which it emerged with a rounded end; when a segment of the issuing jet was cut, the lines of flow could be seen. In the pressing of iron and steel there are lines of flow. Mr. Roberts-Austen illustrated this by means of a crosshead sent to him by Mr. Webb, of the Crewe Works. The lines were made visible by etching. Ruskin had once made the remark that as men stamped the cow upon the butter, why not stamp the bee upon the honey? It simply was not practicable, because honey flows at the normal temperature. The lecturer continued that the most important application in industry with which he was acquainted, connected with the flow of metals under pressure, was suggested by Mr. Baker for the preparation of the steel for the Forth Bridge. He then illustrated the flow of pewter, by pressing a disk of it in a lathe, and showed how Sir Henry Bessemer had made cold-spun ornamental articles from disks of mild steel, 11 inches in diameter. On applying tension, he said, to steel or iron, the metal will extend to a certain point, then there is a permanent set, after which it will begin to flow, and continue to flow until it breaks. Standard gold will do the same, but the presence of a "trace" of lead will prevent the "flow" entirely.

Professor Roberts-Austen next drew attention to the experiments of Professor Walter Spring, of Liege, in the submission of cold and powdered metals to immense presssure. The apparatus (which was shown) used consisted of a ponderous lever press, with heavy weights at the end farthest from the fulcrum, as well as the means of applying screw pressure. The little piston which gave the pressure to the powder passed through a gun metal cap, which had a tap wherewith it was connected to an air pump, so that the air was withdrawn from the interstices of the metallic grains. In 1882 he (Mr. Roberts-Austen) had repeated and verified M. Spring's experiments and results, some of which are set forth in the following table:

Results obtained by M. W. Spring by the Compression of Finely Divided Metals.

Lead	welds at a pressure of		13	tons per	square inch.
Zinc	"	"	19	"	"
Tin	"	"	32	"	"
Antimony	"	"	38	"	"
Aluminum	"	"	38	"	"
Bismuth	"	"	38	"	"
Copper	"	"	38	"	"
Lead flows at		"	33	"	"
Tin	"	"	47	"	"

When more pressure than fifty tons to the inch is given by the machine, the metals submitted to its action begin to flow through the fine cracks of the compressing chamber, just as if the metals were so much treacle; for instance, when tin filings are made perfectly clean, the interstitial air removed, and then submitted to pressure, they form a solid little cylinder with wings where the metal has streamed into the cracks, as exemplified by the result which he then exhibited. He also exhibited a wire of lead which had been pressed into that form from fine powder, which wire had a breaking strain very little less than if it had been formed by a melting process. M. Spring has proved that it is possible to press powdered crystalline metals into masses of another crystalline structure, just the same as by fusion; also, that it is possible to actually build up alloys by pressure. Were the old alchemists, then, right in the idea that bodies never combine except when in solution? Experiment proved that solution is not necessary. Chloride of mercury and iodide of potassium are both anhydrous salts. He would triturate them together by means of a mortar and pestle, and they would see that a red colored iodide of mercury would be produced. The lecturer then took a little pressed bar, made originally from a mixture of powdered tin, bismuth, cadmium, and lead, in suitable proportions, and proved by experiment that those metals had been compressed into a true alloy, which would melt below the temperature of 100 degrees, or far lower than the melting point of the most fusible constituent of the alloy. He applied the heat by means of melted paraffine, since the bubbles in boiling water would not have permitted a clear image of the experiment to be projected upon the screen by the electric lantern. It may be argued, he said, that the heat of the compression of the metals sets up incipient fusion. M. Spring had pointed out that the pressure was applied with extreme slowness, and that if all the work were translated into heat, that heat would not be sufficient to account for the result. M. Spring had also by direct experiment given evidence that the heat was below 28 degrees, and he had asked, Is the union of the metals due to regelation? Faraday discovered in 1850 the regelation of ice, which had enabled Dr. Tyndall to render splendid service to science by furnishing the key to the explanation of the nature of the movements of vast masses of ice, for glaciers owe their motion, not to viscosity, but to regelation. Bismuth is a metal which exhibits the phenomenon of regelation. It is difficult to believe, said M. Spring, that ice alone possesses the property of regelation; give other bodies the same relative conditions—give them the necessary pressure, temperatures, and times, will not the same results be evolved? The grains of powdered nitrate of soda or phosphate of soda in a bottle will slowly unite. May there not, however, said the lecturer, be in the compression of gases an analogy to the liquefaction of gases? In gases the molecules are free, but by pressure they are condensed into liquid form by being brought into spheres of mutual action, and metal, by being powdered, may be said to be coarsely gasified. He regretted that the time allotted for lectures would not permit him to enter into all the particulars he desired to give, but he would add that metals, like liquids, could not only be vaporized, and would absorb gases, but exhibited something like surface tension. He here took a thick horizontal wire of an alloy of gold and silver, resting upon its two ends, and merely touched its center with a soluble chloride; after the lapse of a minute or two the surfaces of the thick wire cracked, and in such a manner as to suggest surface tension. Mr. Fletcher, he said, had first pointed this out to him. Professor Roberts-Austen then concluded by pointing to the influence of the facts they had considered on art, on science, and on industry.

How to Avoid Premature Old Age.

The following good advice is given by Dr. Benjamin Ward Richardson: The rules for the prevention of senile disease are all personal. They should begin in youth. It should be a rule among grown-up persons never to subject children to mental shocks and unnecessary griefs. When, in the surrounding of the child life, some grave calamity has occurred, it is best to make the event as light as possible to the child, and certainly to avoid thrilling it with sights and details which stir it to the utmost, and in the end only leave upon the mind and heart incurable wounds and oppressions. Children should never be taken to funerals, nor to sights that cause a sense of fear and dread combined with great grief, nor to sights which call forth pain and agony in man or in the lower animals.

To avoid premature old age in mature life, the following are important points to remember:

Grief anticipates age. Dwelling on the inevitable past, forming vain hypotheses as to what might have been if this or that had or had not been, acquiring a craze for recounting what has occurred—these acts do more harm to future health and effort than many things connected with real calamity. Occupation and new pursuits are the best preventives for mental shock and bereavement.

Hate anticipates age. Hate keeps the heart always at full tension. It gives rise to oppression of the brain and senses. It confuses the whole man. It robs the stomach of nervous power, and, digestion being impaired, the failure of life begins at once. Those, therefore, who are born with this passion—and a good many, I fear, are—should give it up.

Jealousy anticipates age. The facial expression of jealousy is old age, in however young a face it may be cast. Jealousy preys upon and kills the heart. So, jealous men are not only unhappy, but broken hearted, and live short lives. I have never known a man of jealous nature live anything like a long life or a useful life. The prevention of jealousy is diversion of mind toward useful and unselfish work.

Unchastity anticipates age. Everything that interferes with chastity favors vital deterioration, while the grosser departures from chastity, leading to specific and hereditary disease, are certain causes of organic degeneration and premature old age. Thus chastity is preventive of senile decay.

Intemperance anticipates age. The more the social causes of mental and physical organic diseases are investigated, the more closely the origin of degenerative organic changes leading to premature deterioration and decay are questioned, the more closely does it come out that intemperance, often not suspected by the person himself who is implicated in it, so subtile is its influence, is at the root of the evil.

When old age has really commenced, its march toward final decay is best delayed by attention to those rules of conservation by which life is sustained with the least friction and the least waste.

The prime rules for this purpose are:

To subsist on light but nutritious diet, with milk as the standard food, but varied according to season.

To take food, in moderate quantity, four times in the day, including a light meal before going to bed.

To clothe warmly but lightly, so as that the body may, in all seasons, maintain its equal temperature.

To keep the body in fair exercise, and the mind active and cheerful.

To maintain an interest in what is going on in the world, and to take part in reasonable labors and pleasures, as though old age were not present.

To take plenty of sleep during sleeping hours. To spend nine hours in bed at the least, and to take care during cold weather that the temperature of the bedroom is maintained at 60° Fah.

To avoid passion, excitement, luxury.

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ENGINEERING INVENTIONS.

A car-axle-box brass has been patented by Messrs. Daniel Reynolds and Joseph S. Murray, of Allegheny, Pa. It covers only about one-fifth of the surface of the axle journal, instead of almost one-half, as the common broad brasses do, and is intended to reduce friction and wear, make the lubrication more effective, and economize the hauling and driving power.

A car coupling has been patented by Mr. George H. Lipe, of China Grove, N. C. This invention has for its special object to provide for easily uncoupling cars jammed or crowded together when they stop, the coupling pin being supported by an apertured sliding plate which is forced back by the approaching car to allow the coupling pin to fall to couplingposition.

A cable traction for street cars has been patented by Mr. Orlando H. Jadwin, of New York city. This invention relates to the gripping attachments and covers improvements on former patented inventions of the same inventor, relative to relieving the cable of the weight of the gripping attachment by a counterbalance and the means of attaching the grip to the car by links, so the gripping attachment was made to lift with the cable away from its supporting pulleys.

AGRICULTURAL INVENTIONS.

A cultivator has been patented by Mr. Norris H. Shepardson, of West Halifax, Vt. It is so made that it can be readily extended or contracted in width, and can be conveniently turned around and moved from place to place, the invention covering a novel construction and combination of the various parts.

A plow has been patented by Mr. Wellington Shaver, of Medusa, N. Y. The construction is such that the plow can turn a furrow up hill more effectively than an ordinary plow, while it is also designed to prevent sods, clods, lumps, or other rubbish from passing over the mould-board into the central part of the plow, and thus clogging or choking it.

A plow has been patented by Mr. Andrew McLean McGregor, of Moss Point, Miss. This invention provides for such a construction of plows that they can be readily adjusted for use as a right or a left plow, or a right and left plow, as may be required, which will be strong and simply made, while the various parts can be made small and the implement used as a hand plow.

A self-clearing breaking plow colter has been patented by Mr. Benjamin C. Brownell, of Center Junction, Iowa. A spindle-like roller with an outwardly flaring top extends upward and backward from the point of the colter, and operates so that when the plow catches obstructions they are forced up and catch the roller, which revolves and discharges itself.

A rotary colter has been patented by Mr. John Feger, of Lenzburg, Ill. The object of this invention is to make a colter for plows in which the cutting plates will be held securely in position, and the parts subject to wear can be readily taken out and replaced by new ones.

MISCELLANEOUS INVENTIONS.

A latch has been patented by Mr. Francis Keil, of New York city. The invention consists of novel locking devices in connection with the dog by which the bolt is retracted by a key from the outside, and in a peculiar form of key for the outside locking mechanism, with other special details.

A chimney support for telegraph wires has been patented by Mr. Albert Potts, of Philadelphia, Pa. It consists of a frame clamped to the chimney top and supporting a short telegraph pole suitably braced, the frame and the pole carrying insulators for supporting the electrical conductors in the usual way.

A wrench has been patented by Mr. Michael S. Weller, of Charlestown, W. Va. It has a novel construction by means of which a face section is removably held to one of the jaws of the wrench, being an improvement in that class of wrenches known in the trade as "alligator wrenches."

A washing machine has been patented by Mr. Elmer E. Allison, of Hillside, Pa. It consists of a tub with a rubber to be operated to rub and squeeze the clothes on the bottom of the tub, the rocking of the rubber rubbing and squeezing the clothes between rubber disks and cleats in the tub.

A folding music stand has been patented by Mr. Oswald S. Vaughan, of Glasgow, Mo. It is an arrangement of tubes and rods so pivoted and joined together that the stand can be folded very compactly for carrying conveniently by a handle, and can be quickly set up as a strong and durable stand.

A sash fastener has been patented by Mr. Robert Kemper, of Foster, Ky. This invention consists in a special design of a lever, to which is pivoted a brace lever, making a simple device for locking sashes so they cannot be raised from the outside, and for holding the sash at any desired elevation.

An extension table has been patented by Mr. George Schmitt, of New York city. This invention covers improvements on a class of extension tables formerly patented by the same inventor, and consists in a novel construction and combination of the various parts of the table.

A saw mill dog has been patented by Mr. Nathaniel J. Cushman, of North Paris, Me. This invention covers a special construction and arrangement of parts to provide for the carriages of saw mills a dog for clamping green frozen logs upon the saw mill carriage while being sawed into boards, planks, or joist.

A riving machine has been patented by Mr. Israel A. Davis, of Englewood, Cal. Combined with a series of frows or knives is a rotary shaft passed loosely through their upper ends, with arms mounted on the shaft between the frows and constructed to remove the split material, with other novel features, making an improved machine for splitting boards, shingles, etc.

A flood gate has been patented by Mr. John Dailey, of Van Wert, O. It is intended to prevent animals from passing up or down a stream, but is so arranged that when struck by any heavy debris it will swing and be automatically raised to allow its passage, the gate being so mounted that it may be raised quite a distance above the bed of the stream if desired.

A shipping tag has been patented by Mr. John A. Pegg, of Jonestown, Miss. It is a metal tag or label through which the shipping marks are to be punched, the metal plate having serrated edges on two opposite sides, and flanges, the tag to be secured to a tie by springing the flanges with a pair of pliers with wide jaws.

A lead for setting stained glass has been patented by Mr. Jacob Pfleging, of New York city. It is a lead having grooves formed in it in combination with stiffening strips made of plates of tin or other metal, both edges of the strips being grooved, such plates rendering the panels sufficiently firm and rigid without separate braces or rods.

A coffee roaster has been patented by Mr. Mathias A. Laska, of New Orleans, La. The stirring arms or blades are placed loosely on the revolving shaft, and held in contact on the bottom of the roasting pan by a spiral spring, preventing the coffee beans from clogging up the arms, and roasting them equally and effectually.

A stove pipe damper has been patented by Mr. George C. Fraser, of Port Sanilac, Mich. The pipe has semicircular partitions and pivoted semicircular damper valves arranged therein, so the smoke and draught must pass through the pipe on a zigzag line, and the partitions stop the sparks, permitting the easy government and regulation of the fire.

A churn has been patented by Mr. Peter Hauersperger, of Urbana, Ill. The cream box is rectangular in horizontal cross section, and is formed with a wedge-shaped bottom, which permits a small quantity of cream to be churned with as much care as a larger amount, the churn being an oscillating device which may be constructed of either wood or metal.

A wood carrier has been patented by Mr. Charles G. Fransson, of Norway, Mich. It consists of a strip of canvas so folded as, with gores, to form a pocket, the ends being provided with bars, the canvas having hand holds to grasp the bars, and the bars also having hooks and eyes by which the canvas can be fastened around the bundle of wood.

A sheep protector has been patented by Mr. William L. Lewis, of Sweet Springs, W. Va. It has about the shape of a horse coat or covering, and is made of oiled sail cloth or rubber fabric or other similar material, and is specially cut and fitted so it will not hold snow and moisture, and will thus be an effective protector for animals against the weather.

A velocipede has been patented by Mr. Samuel Martin, of Mill Rock, O. It has two driving wheels actuated by hand and foot levers, a swinging frame and seat, a guide wheel in turning bearings, and a specially devised brake, and it is to be propelled by one, two, or more persons, being adapted to attain a great rate speed, and to carry passengers and freight.

A windmill has been patented by Mr. Jules R. Desjardins, of Burlington, Vt. It has a novel mechanism for adjusting the stops that regulate the position of the hinged fans or sails, to provide for checking the speed of the wheel automatically when the wind pressure is excessive, and when the wheel is not in use it can be arranged so that the fans offer no resistance to the wind.

A book clasp has been patented by Mr. Jacob Monch, of Offenbach, Germany. It consists in a hollow slotted pintle containing a threaded spindle, one-half of which is threaded with a right handed thread and the other half with a left handed thread, by which specially devised arms can be spread or contracted, so a book, album, or file fitted therewith will be adapted to contents of variable quantity.

A vehicle brake has been patented by Mr. James L. T. Linson, of Johnson County, Mo. This invention covers certain novel features of construction and combination of parts, so that when the draught is applied the brakes will be taken off the wheels, and so held, and when the vehicle moves suddenly forward on a down grade, the brakes will be automatically applied to the wheels.

A chain bolt for doors has been patented by Mr. James B. Hawes, of North Tarrytown, N. Y. Combined with a sliding bolt and its chain applied to a door and casing or a double door is a supplementary chain with one end connected to the other chain or its support, and the other end detachably connected to the bolt or its chain, the device being also for use as a door fastening when the doors are fully closed.

A whale shaped museum building has been patented by Mr. Anthony Ward, of Brooklyn, N. Y. It has a movable lower jaw, with movable teeth, to admit spectators, and gravity cars to carry them out, while there are ventilating openings in the back, and above the back are placed perforated pipes, whereby a fine spray of water can be showered upon the back of the whale to keep the main chamber cool.

A shingle has been patented by Mr. Robert C. Snowden, of Elizabeth, Pa. It is formed of sheet metal, having interlocking portions and provided with a lateral horizontal flange terminating short of the end of the shingle, whereby to form a stop for the adjacent shingle, with other novel features, to combine ornamentation with strength and ease of application and removal.

A tension mechanism for spindles of metal working machines has been patented by Mr. James Hartness, of Torrington, Conn. Combined is a cross pin or key, a spring acting on the key, and a cam plate on which the key is turned, with other novel features in an improved spindle, intended to allow the tool to yield as the strain approaches the breaking point, but not to yield until this point is almost reached.

A safety attachment for watches, etc., has been patented by Mr. Otto G. Faber, of Washington, D. C. Combined with a chain swivel having a supplemental hook and a latch for closing the same is a back plate with perforations, supporting bail, and other novel features, to prevent watches from being dropped out of or stolen from the pocket, while the attachment is one which can be conveniently applied to a garment.

A stove has been patented by Mr. Frank Brielmair, of Nashville, Tenn. It has a partition on one side of the firebox, between which and the outer wall is a compartment having slides, and a perforated outer casing through which a lug on the slide passes, the partition having apertures at its top and bottom, with other novel features, for the more perfect regulating of the draught.

A machine for making lead pipe has been patented by Mr. Christopher C. Tracy, of Brooklyn, N. Y. This invention consists principally in a movable receiving reservoir, which can be moved to and from the point of alignment with the die holder, thus facilitating the removal of the mandrel as desired for replacing it with others for different sizes, and also the pouring of the molten metal.

A beer and water cooler has been patented by Mr. Joseph F. Shomate, of El Dorado, Ill. There is a refrigerating box for receiving the barrel or keg, and another box with a cylinder, the liquid being conducted from the barrel through this cylinder, which is surrounded by broken ice, and the whole being mounted on castors for ready moving from place to place.

A gas regulating burner has been patented by Messrs. Joseph J. Butcher and Johann H. Wuster, of Newcastle-upon-Tyne, England. A small permanent flame is used, beside the larger burner which has to be lighted, and the working part of the apparatus consists of a valve actuated by the pressure of the gas, the edges of the valve being sealed by mercury, there being a pressure governor, which may or may not be used with the apparatus.

NEW BOOKS AND PUBLICATIONS.

THE AMATEUR PHOTOGRAPHER. By Ellerslie Wallace, M.D. Philadelphia: Porter & Coates.

The art of photography has, of late, attracted so many enthusiastic amateurs, that a large and increasing literature has sprung up to meet the inquiries of the beginner. Of the host of writers who have thus endeavored to throw some light on dark places, probably none has succeeded better than Dr. Wallace. His convenient little manual presents a clear and concise description of the different apparatus and processes. An ardent amateur himself, at a time when the mysteries of the art were little known outside of the professional studio, the author has had an excellent opportunity to study the development and merits of recent methods. So well has he availed himself of this opportunity, that he is now a recognized authority on the subject. While the size of the book prevents it from being at all exhaustive, it covers as much ground as the ordinary amateur will have time to master, and can be recommended to him as a trusty guide.

ASSIGNMENTS OF PATENT RIGHTS. Compiled and arranged by Schuyler Duryee, Chief Clerk of the U. S. Patent Office. Washington: Schuyler Duryee, 1886. Price $3.

Numerous questions respecting the assignment of patent rights are constantly arising. To answer them intelligently, it has heretofore been necessary to search through an almost equal number of works of reference. Mr. Duryee's experience, as Chief of the Assignment Division of the United States Patent Office, gave him an opportunity to feel the urgent need of a classified digest of decisions relating to the transfer of patent rights. It is the purpose of his work to supply this want, and as far as we have been able to examine it, he has succeeded admirably. An alphabetical list of cases cited precedes the index. A digest of decisions and the statutes relating to assignments are then given. The proper forms for all deeds respecting the whole or partial transfer of patent property, or its use under specified conditions, are exhibited in full. The work will be found a valuable addition to the literature of patent law.

Education (Wm. A. Mowry, publisher, Boston) for April contains a number of interesting papers on educational subjects. "The Relation of the Secondary School to the College," by Mr. Willard, offers several valuable suggestions regarding the adoption of a uniform standard for admission of students to colleges and the establishment of some degree of co-operation between these institutions and the preparatory schools. The development of the Amherst idea, as described in Mrs. Houghton's "Evolution of a College Republic," is of particular ethical interest. Dr. Lowrey also continues his discussion of the "Philosophical Phase of a System of Education." Current events are well presented in the editorial columns.

The Lidgerwood Manufacturing Company, whose works are in Brooklyn, N. Y., and who have salesrooms in both New York and Boston, have just issued a handsome illustrated catalogue of their hoisting engines, of which they make a great variety, and of their stationary and marine boilers and general steam fitttngs.

Messrs. Jones & Laughlins, of Pittsburg, Pa., present a new illustrated catalogue of their cold rolled steel and iron shafting, couplings, pulleys, pulley stands, binder frames, jib frames, etc. In this connection are appropriately added Professor Thurston's conclusions as to the advantages of cold rolled iron and steel, with a list of shapes and sizes of iron and steel supplied cold rolled by the firm.

Messrs. Guild & Garrison, of Brooklyn, N. Y., describe some of the most important of their steam pumping machinery in a recently issued catalogue. Besides making pumps for almost every known industrial use, the firm also make air and gas blowers, high speed air compressors, etc.

Special.

ANOTHER HOUSEHOLD NECESSITY.

Mr. Wild, the Inventor of Linoleum, notes a Discovery as Valuable as his Own.

Fifteen or twenty years ago it was found that a floor-covering could be made, looking like oilcloth and lasting as long or longer, and yet without that coldness to the tread which is one of the peculiar characteristics of oilcloth. The new article was made of very finely ground particles of cork, mixed with linseed oil and other substances in mysterious ways which need not here and now be described. "Linoleum" was the name selected for it. At first it was put before the public on a very small scale. But its merits created a great demand for it, and it is now a household institution, both in this country and in England. At the head of the Linoleum business, in this country, is the well known house of Joseph Wild & Co., of 84 Worth St., New York.

The senior partner of this firm is Joseph Wild, Esq., a resident of South Brooklyn, and one of the most hearty looking gentlemen of his age anywhere to be seen. He is considerably over seventy, with snow white hair, erect form, and a very cheerful countenance. To look at him one would suppose he never had suffered a day's illness in his life. Yet there was a time when Mr. Wild was an invalid, worn by active attention to business, and seeming to be on the verge of total nervous prostration. Concerning his invalidity and his restoration to health, one of our correspondents recently had a little conversation with him at his store.

"They tell me you were considerably run down in health, Mr. Wild?"

"It is very true, sir. I was not bed-ridden, nor was I entirely laid aside from business, but I had given myself very closely to my business affairs, and my duties in connection with the church and some of the Baptist benevolent societies had weighed heavily upon me. A younger man than I might not have felt these burdens as I did, but at my time of life they began to make their mark on my constitution. I felt a lack of vitality, and realized that my nerve power was about to fail me. My appetite was not as it formerly had been, and my digestion was somewhat disordered. I needed, in fact, revitalization. About this time I heard of Compound Oxygen, and I made inquiry of Dr. Turner, in charge of the New York office of this remedy, to see if it could be applicable to me. Learning from him that others who had been run down as I was had been benefited by the Compound Oxygen, I procured a 'Home Treatment,' with considerable doubt as to whether or not it would do me any good. This was about two years ago. Since that time I have been taking Compound Oxygen, not all the time, but frequently at intervals, when I have felt the need of it."

"Then you received decided benefit from it at the outset?"

"Very soon after I began to inhale I found that I was receiving new strength. And I was glad to note that it was real strength, and not a mere stimulus. I noted also the steadiness of my improvement. There was no falling back, but a constant and reliable advance. Daily I could feel an increase of vitality. My spirits were better and my power of action was greater. I was able to attend to my business and to all my other duties with far less strain on me than I had for some time previously experienced."

"And so you now find yourself as well as ever, and beyond the necessity of medicine?"

"For a man of my years I am as hearty and vigorous as I can expect. I am free from disease and pain, and am attending to as much detail of business as if I were only fifty years old. As to medicine, I have no use for it, drug medicine I mean. I do not call this Oxygen exactly a medicine; certainly not in the sense that drugs are medicinal. I regard it as a wonderful vitalizer and invigorator. And it is as such that I even now occasionally resort to it when I feel the need. I keep it in the house and intend to continue doing so."

To the many gentlemen of advancing years who are overworked and weary, and who feel themselves in need of revitalization, Compound Oxygen is, as in Mr. Wild's case, a valuable helper. The late T. S. Arthur, of Philadelphia, was brought almost from the grave by this means when he was quite an old man, and by it his life was prolonged for a number of years. The Hon. Wm. D. Kelley, of Philadelphia, who is beyond seventy, attributes to Compound Oxgen his recovery from what had been pronounced a fatal disease. He still uses the Oxygen as a vitalizer, and is in vigorous condition, attending to his legal and congressional duties as actively as of old.

For a valuable treatise on what Compound Oxygen is and what it does, write to Drs. STARKEY & PALEN, 1529 Arch Street, Philadelphia. The treatise will be mailed free of charge.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Carbon Plates. Bowe, 26 Harmon St., Jersey City, N.J.

For Sale—2d hand Daniels Planer (24 in. wide, with 15 ft. carriage), just put in thorough repair. Price $150 (a bargain). Address Witherby, Rugg & Richardson, Worcester, Mass.

For Sale—Patent for Keyless Combination Alarm Door or Drawer Lock.—T. Mabbett, Jr., 130 Dock Street, Philadelphia, Pa.

Wanted—A mechanical engineer of experience to take charge of the mechanical department of our shops. Address, with references, U. S. Cotton Harvester Co., Room 68, Cotton Ex. Building, New York city.

Wanted—An experienced foreman for a machine shop in the West, employing an average of 50 hands; must be thoroughly conversant with engine practice and general machine work, with experience in the economical management of men. Give reference and salary expected. Address "J. M. H.," P. O. Box 773, New York.

Send to the *Railroad Gazette*, 73 Broadway, New York, for a catalogue of Locomotive, Track, and other railroad books.

Emery Wheels of unusually superior quality for wet grinding. The Tanite Co., Stroudsburg, Monroe Co., Pa.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

Wanted—To correspond with a practical door, sash, and blind maker; one who would be fully competent to take full charge of a factory and could give correct estimate of machinery needed, cost of manufacture, probable demand and margin. One that could take an interest would be preferred. Address Mr. H. H. Durkee, 43 Broad St., New York.

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A competent steam engineer and mechanic wanted. Address box 5169, Boston, stating wages.

See Burnham Automatic Engine adv. last and next week.

Curtis Return Steam Trap returns all condensations *into* the boiler without waste. Curtis Regulator Works, Boston, Mass.

Wanted.—A Mechanical Draughtsman wanted to go West. One acquainted with wood working machinery preferred. Steady employment to a sober and industrious man. Address, with full particulars, stating wages expected, etc., "Western," P. O. Box 773, New York city.

Wanted—Patented articles of merit to manufacture on royalty. Electric Mfg. Co., 311 River St., Troy, N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder*." A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Grimshaw.—Steam Engine Catechism.—A series of thoroughly Practical Questions and Answers arranged so as to give to a Young Engineer just the information required to fit him for properly running an engine. By Robert Grimshaw. 18mo, cloth, $1.00. For sale by Munn & Co., 361 Broadway, N. Y.

Wm. Frech, Sensitive Drill Presses, Turret and Speed Lathes combined, Power Punching Presses, 68 W. Monroe Street, Chicago.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Haswell's Engineer's Pocket-Book. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form, $4.00. For sale by Munn & Co., 361 Broadway, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Nystrom's Mechanics.—A pocket book of mechanics and engineering, containing a memorandum of facts and connection of practice and theory, by J. W. Nystrom, C.E., 18th edition, revised and greatly enlarged, *plates*, 12mo, roan tuck. Price, $3.50. For sale by Munn & Co., 361 Broadway, New York city.

Tools, Hardware, and other specialties made under contract. American Machine Co., Philadelphia.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Cyclone Steam Flue Cleaners are the best. Crescent Mfg. Co., Cleveland, O.

Curtis Pressure Regulator and Steam Trap. See p. 142.

Cushman's Chucks can be found in stock in all large cities. Send for catalogue. Cushman Chuck Co., Hartford, Conn.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Friction Clutch Pulleys. D. Frisbie & Co., Phila.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 158.

"Wrinkles in Electric Lighting," by V. Stephen; with illustrations. Price, $1.00. E. & F. N. Spon, New York.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

"Affliction sore long time he bore
Physicians were in vain."

But had he used Dr. Pierce's "Golden Medical Discovery," the greatest blood purifier known, he might still be living. For all scrofulous diseases this preparation is a sovereign and never-failing remedy. All humors, from a pimple to an ulcer, yield to it. It will cure consumption (which is a scrofulous disease of the lungs) if taken in time. All druggists have it.

Catarrh, Catarrhal Deafness, and Hay Fever permanently cured by a new treatment, in from one to three simple applications, made at home. Send stamp for descriptive pamphlet to
Dixon & Son, 303 West King St.,
Toronto, Canada.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. A. K. writes: I have a telephone wire running from my house to the store; how can I attach a ground wire to prevent lightning from following the telephone wire into the house or store? A. Carry a wire from your gas fixtures or water pipes to the vicinity of your telephone. Let it terminate in a metal comb about two inches long, with forty or fifty sharp teeth like a saw. Screw this to a board. Opposite, and with its teeth facing those of the first comb, place a second one connected to the line wire near the telephone, between it and the line. Have the teeth of the two combs as close as possible without absolute contact existing. Use one of these attachments at each end of the line.

(2) E. R. W. asks: 1. Does it take a current of higher tension to run an incandescent lamp then an arc lamp? A. In general terms, it is the other way; more intensity is needed for the arc light. 2. Will a ten inch Grenet cell run a 6 candle power incandescent light? A. No. 3. Suppose I wish to light a private residence with incandescent lamps; would it be economical and profitable to use a Shipman automatic engine to run a dynamo of sufficient size? A. Electric lighting on the small scale with special plant is not economical as a rule. 4. What is the best battery for telegraphic purposes? A. For closed circuit, gravity (sulphate of copper) batteries are largely used. For open circuit work, Leclanche cells.

(3) J. T. D.—A solution of orange shellac in alcohol is generally used on the plates of electrostatic machines.

(4) C. P. K. asks: Will a solution of bichromate of potash and sulphuric acid corrode or eat its way through a wooden tank lined on the inside with lead? Can the same fluid mixture be contained in a wooden tank coated outside and in with asphaltum varnish? If so, how long would such a tank last? A. Either tank will answer for battery fluid for an indefinite period. If oil of vitriol and bichromate of potash, undiluted by water, were used, then a lead lining would be requisite. Exact durability cannot be given.

(5) H. W. B. asks: 1. What difference does it make in the strength of an electro magnet whether the coils are wound in regular layers or put on roughly? A. The power of an electro magnet depends on the proximity of the exciting wire to the core and on the number of convolutions. To secure these ends, the wire should be smoothly laid. 2. Which would work best on a short telephone line of 200 feet in length—telephones wound with No. 34 cotton-covered wire or those wound with No. 36 wire? A. The No. 34 wire telephone. 3. What is the penalty for making, selling, or using a telephone? A. This is determined in the courts; there is of course no statutory penalty. 4. What could be done to a person for connecting a telephone to a line wire if it did not interfere with the working of the line, and he could not use it for conversing, but only for listening? A. This might give rise to a suit for infringement or for trespass, or possibly something much more serious than either of these. 5. Where is the best place to take a course in electrical engineering, and also in mechanical engineering, with length of courses? A. The Stevens Institute of Technology, Hoboken, N. J.; the Boston Institute of Technology, Boston, Mass.; or the Sibley Mechanical College of Cornell University, Ithaca, N. Y. The course is generally four years.

(6) O. W. asks how to make a cheap and also a very good battery. I have three glass jars, each about 8 inches high and 6 inches wide. A. Use flat carbon plates, about 8 inches by 4 inches by ⅛ inch, and zincs to match, but thinner. Amalgamate the zincs by rubbing with mercury, keeping the surface moist with dilute sulphuric acid. One zinc may be used as a rubber for the other. For exciting fluid, mix five fluid ounces of oil of vitriol with three pints of cold water, and after it has cooled add six ounces finely powdered bichromate of potash. A little nitric acid will improve the constancy. Each cup contains one plate of zinc and one of carbon; connect zinc of one to carbon of next; do not let the plates touch each other under the fluid.

(7) W. J. McC. asks how to take the sound off an acoustic telephone into a receiver, and also how to make the receiver? A. Acoustic telephones, so called, consist of two similar instruments, one at each end of the line. Each instrument is substantially a tense drumhead, generally somewhat funnel shaped. To its center is attached one end of the line wire, which may be of steel, and which strains the membrane by its pull. The line wire is directed in its course by loops of leather or muslin. Sharp bends are prejudicial. The wire must be tightly strained from drumhead to drumhead. On speaking into one instrument, the sound is repeated in the other. We refer you to advertisements in our columns.

(8) F. D. H. asks: 1. What gears are required to cut a thread of 9½ per inch on a single geared lathe, whose lead screw is 6 per inch?

A. Spindle	12	24	36	48
	— or	— or	— or	—
On screw	19	38	57	76

2. What cement will resist the action of alcohol (for an unlimited time), and will attach smooth metal to glass? A. Glue and whiting if the alcohol is anhydrous.

(9) A. H. H.—The independent cut-off in a steam engine is more perfect in its action and considered more economical than cutting off and exhausting by one valve. Engines with independent cut-offs are more expensive than the plain ones. Good clean tin cans are worked up into stamped goods, such as toys, etc., but will not pay freight charges.

(10) C. C. S.—In both the Bessemer and Clapp-Griffiths process, the silicon is first oxidized and combines with the ferrous and manganous oxides to form a siliceous slag. The carbon then burns, the disappearance of the carbon flame indicating the end of the reaction. We believe that a basic lining has never been used in the Clapp-Griffiths converter, but there is no reason why it should not be. The mixture of fire clay and magnesia which you suggest would not work, as any excess of silica in the slag would set free the phosphorus anhydride from any oxide of iron with which it had combined, and the phosphorus would be again reduced by the carbon, or, at such an elevated temperature, even by the iron itself. You would thus defeat the very purpose for which the magnesia and lime are employed.

(11) K. E. E. M.—The furnace referred to in our article on the Clapp-Griffiths steel process as having produced 325 tons of pig iron in 24 hours is located at the Edgar Thomson Steel Works, Bessemer, Pa. We believe that it is designated as "Furnace D," and that the diameter of the bosh is 21 feet, the height of the shaft being over 100 feet. As far back as the spring of 1883, it had produced 305 tons of pig metal in 24 hours, and we were informed, at the time of our last visit to the works, in February, that the record since then had reached 325 tons.

(12) W. R. P. asks the highest temperature (C. scale) yet produced by combustion, also by electric arc? A. 1,600° C. in steel furnaces. About 2,500° C. by hydro-oxygen blowpipe. Probably 500° higher by electric arc.

(13) N. T. G. asks: What will darken the color of a mustache without using common dyes? A. There is nothing more satisfactory than the common silver hair dyes. An excellent brown dye is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 356, under title of "A Bismuthic Hair Dye." The expressed juice of the bark or shell of green black-walnuts is the simplest form of hair dye.

(14) M. H. S. writes for a recipe for the glaze known as salt glaze, such as is used on cheap yellow and Rockingham pottery. A. Common salt is placed in the oven with green wood for fuel to form an irriguous smoke. This the salt, heated to redness, receives, and is decomposed into hydrochloric acid and soda, the vapors of which fill the oven. The inside and outside of the vessel submitted to this process are thus simultaneously glazed. See Wagner's Chemical Technology, under "Pottery."

(15) F. G. B. desires a receipt for coloring the skin to a dark complexion and a preparation to take it off. The color to be that of a Cuban or Spaniard. A. The general principle in making such preparations consists in mixing the dry powder, a little darker than the desired tint, with some fat, such as petrolatum or lard. A formula for a brown face paint is as follows. Take of:

Burnt umber	1 part.
Cacao butter	6 parts.
Oil of neroli	5 drops.

Melt the cacao butter, add the umber, and while cooling make an intimate mixture, adding the perfume toward the last. Wash it off with vaseline.

(16) W. M. B. asks: How are silver flowers worked into iron for ornamentation? A. The design is etched out of the iron by means of acids, and the silver is then brazed in and polished down.

(17) D. H. N.—The largest driving wheel on a locomotive in the world is said to be that of one built for the Bristol and Exeter Railroad, England, in 1859. It was originally 9 feet in diameter, but its size was reduced, and is now 8 feet 10 inches.

(18) M. F. D. asks (1) a method for effectually deodorizing carbon bisulphide. A. Distill the carbon disulphide with quicklime, the two substances having been in contact for 24 hours. The distillate to be received in a flask partially filled with clean copper turnings. 2. In a mixture of rubber cement, with a given quantity of ultramarine blue added, does the ultramarine blue add to the unpleasant odor of the carbon bisulphide? A. We should think not; but you can obviate any difficulty of that character by using chloroform or ether as a solvent for the rubber.

(19) R. H. R. asks if cast zinc plates will do in a Grove's battery. A. They will answer, but rolled plates are preferable on account of lightness and uniformity of composition and structure.

(20) C. B. H. asks for black ink for use on the hektograph. A. Use a strong aqueous solution of nigrosine (aniline black) in the proportion of about 1 of the coloring material to 5 or 7 of water. It must be a saturated solution, rather thick.

(21) F. R. W. writes: What can be put in melted sulphur to toughen it, so that articles cast from it will not crack when cold? Sulphur alone is apt to crack if heated unevenly. A. When sulphur heated to 230° is suddenly poured into cold water, it remains soft, and so plastic that it may be advantageously employed for obtaining impressions of woodcuts and engraved plates; these impressions, as the sulphur again hardens after a few days, are used as moulds. We know of nothing that can be added to sulphur to lessen its brittleness, but it is used as above described for casts.

(22) E. Y. E. desires a sure way to detect sewer gas in a house, and the remedy. A. There is no direct way of always certainly detecting the presence of sewer gas. It can be inferentially determined where defective plumbing exists. The only remedy is to be sure that your plumbing is perfect.

(23) G. A. D. desires a formula which when applied to highly polished brass will keep it absolutely bright, and free from tarnishing. A. Thinly coat with a varnish of bleached shellac and alcohol.

(24) H. H. says: If I have a tank containing compressed air, 10 pounds to the inch, and the temperature of air in the tank is 80°, what will be the increased space the air would occupy with same pressure, the temperature being raised to 160° Fah.? What is the law or rule governing air under such conditions? A. For approximate calculations allow one-fifth of 1 per cent expansion per degree Fah. The true rule is that air under constant pressure expands one forty-ninth of its volume at 32° F. for each degree F. This would give for your case the following result: 1,000 parts of air at 80° would expand at 160° to 1,148 parts.

(25) W. M. S. writes: I have bought a one barrel breech loading shot gun, Spanish make, very light, and it gives a very strong rebound or kick in firing. A. This is a common fault of light guns. They recoil less with light charges of both shot and powder, but the difficulty cannot be entirely overcome without permanent weight added to barrel and stock.

(26) R. A. H. writes: I saw a man selling what he called a magic glass, a piece of plain window glass, which by breathing on would display figures. How was this done? A. The drawing is made on the glass by means of soapstone or steatite; when breathed on it appears, and disappears as the moisture from the breath dries away.

(27) A. H. G. asks how to color whitewash brown—a cheap color, that will not wash off easily. A. Add brown sienna to the whitewash in order to produce the desired color, and mix with alum or glue water.

(28) J. M. L.—Sugar, glycerine, and gum arabic are the articles used to produce the glossy appearance of ink. Not enough of either must be used to impede the flow.

(29) W. H. asks (1) if there is any fluid compound (not volatile under a temperature of 300° Fah.) more expansive than mercury. A. No. 2. What is the most expansive metal or other solid known not destructible under a temperature of 300° Fah.? A. Zinc.

(30) "4man."—There is no necessary relation of resistances between the secondary coil of the induction coil and the telephone. The primary of the induction should leave about ½ ohm resistance; for the secondary and the telephone, 80 ohms is good.

(31) C. H. S. asks about tempering mill picks. A. There is no special art in tempering mill picks different from the operation with other cutting tools for hard substances. Water at ordinary temperature with a litte salt in it. Do not draw the pick thin, and use great care not to overheat the corners, which is the cause of all the trouble. A slow, dull fire for hammer heating as well as for hardening. "Temper thick and grind thin" is an old maxim.

(32) H. & S. write: We recently bought a keg of poster printing ink (black), which is so thick that it will not distribute on the rollers. How shall we thin it? A. With boiled oil. You have probably been using your ink in a cold room, and it would, most likely, work well in warm weather.

(33) W. L. R. asks: Why is the center of connecting rods of stationary engines made heavier and larger than at the ends? A. To prevent vibration.

(34) C. Q. H. asks the strongest wood, in proportion to its weight, that would be suitable for making framework for a flying machine? A. Lance wood.

(35) G. G. McC. asks how to get a black dye or stain for cast iron that can be varnished. Dip in a solution of gallic acid and water, or make by boiling gall nuts in water, in a glass or earthen jar.

(36) J. H. (of California) writes: I dry quite a good deal of fruit, apricots, peaches, apples, etc., by artificial heat. Fruit is placed on trays made of iron. Have used galvanized iron, but the coating does not last more than one season. I then coat with shellac varnish. Can you suggest anything better and more lasting? A. We know of nothing better than cheese cloth on wood gratings, often renewed, for health and cleanliness.

(37) G. R. asks the acids and any component parts of fluids that make a mantel piece ornament in a bottle, I think zinc and acetic acid. The ornament is inside the glass bottle. A. Dissolve 1 ounce lead acetate (sugar of lead) in 1¼ pints distilled water, add a few drops of acetic acid, place the liquid in a clear white glass bottle, and suspend a piece of zinc in it by means of a fine thread suspended from the cork.

(38) F. E. asks whether water in range boilers heated by water back is suitable for cooking purposes. A. It is objectionable, although the hot water from the range boilers is a great deal used by cooks, for boiling vegetables and meats. If the boiler is tin lined and much water used through it, there is less objection. Water that has remained hot in the boiler a short time gives an unpleasant odor, and if in a galvanized iron boiler, is poisonous.

(39) W. H. R.—Lead 6 parts by weight, bismuth 7 parts by weight, cadmium 1 part by weight, make an alloy that melts at 180° Fah.

(40) G. A. S. writes: I have seen the statement that the greatest number of revolutions ever recorded of a shaft making was 57,000 per minute in a very fine machine built in France to test the speed of light. Is this correct? A. The highest velocity in Wheatstone's apparatus was 48,000 per minute. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 165, for full description. Also SUPPLEMENT, No. 168, for experiments on the duration of the electric spark with speed of 20,000 per minute. Have no doubt that 57,000 is feasible.

(41) W. P. T. says: Please give me the greatest speed of any boat you know of. A. A new torpedo boat by Yarrow & Co.—27·66 miles per hour.

(42) C. F. C. asks how to stop the crack in a plated coffee pot, which got cracked by a fall. A. It will be necessary to coat with solder, and possibly the following simple process will answer: Cut a piece of tin foil the size of the surfaces to be soldered, dip a feather in a solution of sal ammoniac, and paint over the surfaces of the metal; then place them in their proper position, with the tin foil between; keep it so arranged on a piece of iron hot enough to melt the foil. When cold they will be found firmly fastened together.

(43) C. S. asks for an ink or similar preparation, which may be printed upon brass or zinc plates, and that will resist muriatic and nitric acids. A. Take of chloride of potassium ¼ ounce, soft water 1 pint. to be kept in glass and used with a quill pen. 2. An ink that may be printed with upon glass to resist hydrofluoric acid. A. You will find that it is the glass that is attacked by the hydrofluoric acid and not the ink. Any carbon ink, such as printer's ink or asphalt ink, should resist the action of this acid.

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(44) J. T. H.—Gold is worth per troy ounce $20.67183. Rare metals are quoted by the gramme. Reducing this to troy ounces we have, omitting fractions:

Barium	$124.00	per troy ounce.
Calcium	311.00	" " "
Osmium	93.00	" " "
Rubidium	622.00	" " "
Zirconium	496.00	" " "

(45) J. P. writes: I have a marble mantel in my house stained in imitation of porphyry. The staining is wearing off in spots, exposing the white marble; what kind of paint or stain can I use to make it a plain color? A. Marble may be stained or dyed of various colors by applying their solutions to the stone made sufficiently hot to make the liquid just simmer on the surface. Success in the application requires considerable experience. For a brown color, a tincture of logwood is used; for blue, a tincture of litmus is used; and for crimson, a solution of alkanet root in oil of turpentine.

(46) J. H. P. asks whether a wide angle lens is as good for copying or enlarging small negatives as a portrait lens. A. No; it is much slower, and not as rectilinear. For accurate work a Dallmeyer, Steinhiel, rectilinear, or a Ross rapid symmetrical lens, with daylight or a powerful artificial light, is the best.

(47) C. C. writes: Suppose it requires 500 pounds of water at 60° per hour to extract a certain amount of heat, how much air at the same temperature per hour would be required to extract the same heat, and what is the *rationale* of the calculation? A. As the specific heat of water is 1, and the specific heat of air is 0·2377, then 1÷0·2377=4·2 pounds of air to equal 1 pound of water. As air is 773 times lighter than water, and as your 500 pounds of water is equal to about 8 cubic feet, you will require 8×773 or 6,184 cubic feet of air to equal the cooling effect of 500 pounds of water. You will also require a much larger surface for air cooling.

(48) J. B. says: In the SCIENTIFIC AMERICAN of April 3 (query No. 8), A. B. S. asks if a tube sheet that has a crack between the tubes can be repaired successfully. I say yes; thus: drill a hole in the crack midway between the tubes large enough to tap with a taper tap (16 thread), so that the thread will cut a little into each tube, then cut a plug a little tapering and screw it into the hole as tight as it will go, and then cut the plug off a little outside the head, and it will be a success, and last as long as the head will. If the crack is too long for a ⅜ or ½ inch plug to fill, then 2 or 3 can be put in, but each will have to be put in separately, so that the second can be tapped so as to cut into the first a little, and so on.

(49) J. M. asks: How many horse power will it require to furnish steam for a drying room 14×14×8, temperature 120° to 150°? How many coils of pipe, and the best way to arrange them, etc., for drying fibrous plaster plates ½ inch thick? Is steam or hot air preferable? A. You will require about 3 horse power and about 700 feet 1 inch pipe, which may be arranged in a flat coil just above the floor. For ventilating, have a small inlet for fresh air under the coil, so as to spread the air to all parts of the coil and in the same manner ventilate the top, so as to allow all parts an equal escape for the moist air. Steam is best and safest if you have it. If you require steam only for the dry room, a hot air stove is preferable.

(50) H. R. H. asks: 1. What is a good material to use to paint a fireplace and also fender where the japan is burnt away? A. We know of nothing that would be acceptable on the ironwork of a fireplace but the hard-baking japan. 2. Has the tunnel under the British Channel ever been begun? A. About a mile of preliminary tunnel on each side of the channel has been done. The work waits the authority of Parliament.

(51) F. W. L. asks: 1. Is there any cement which is suitable to fill cracks in brass such as those in screwheads, and which will polish down satisfactorily? A. Use shellac melted in. 2. A good recipe for brass lacquer. A. Clear shellac dissolved in 95 per cent alcohol. Settle, and decant the clear lacquer. 3. Is there any cement easy to apply which will make good electrical connections, as, for instance, between German silver wire and the brass or copper plates of a rheostat? A. Nothing but metallic solders.

(52) W. T. B. asks the distance that steam can be carried to advantage for heating purposes with a pressure of about 100 pounds. Also the best method. A. It may be carried several thousand feet in wrought iron pipe through subways of brick or wood; pipe should be well felted, and arranged for taking up expansion.

(53) F. M. asks if there is any difference in the power required to move a live or dead weight on a wagon. A. On a perfectly even track there should be no difference in traction for a load of given weight, whatever its composition may be. On a rough road or cobble-stone street, elasticity in the load becomes equivalent to springs on a wagon, and if not lessening the average power of draught, it mitigates the severity of draught, and in this way makes a difference in favor of live or elastic loads.

(54) W. A. S. asks (1) what pigment to use to color glass panes either a light violet or light green color, the violet preferred. A. Prepare separately an alcoholic solution of bleached shellac or sandarac and a concentrated alcoholic solution of a convenient aniline color. The latter solution is added to the former just before using. It is well to heat the glass slightly before coating, and we think that it will be found better to apply it on the inside. 2. What is the best composition for putty, that would not be broken off either by frost or damp? A. Putty is made of common whiting, pounded very fine, and mixed with linseed oil till it becomes about the thickness of dough; if properly made and used, it is not affected by ordinary cold or damp.

(55) W. S. & Co. ask a way to cover a steam drum of large boilers with a good and cheap cement, etc. A. Asbestos cement and hair felt are both good. If not available, use a thin sheet iron jacket set up around the drum, having 2 or 3 inches of space betweeen jacket and drum, which fill with the dry ashes from the ash chamber at back of boilers. This is cheap and durable.

(56) E. H. McM. asks how compound sulphate of indigo is made, giving quantities, etc. A. Into 5 pounds of the most concentrated sulphuric acid stir by degrees 1 pound of the best indigo, finely ground; expose this mixture to a heat of about 160° Fah. for 10 or 12 hours, stirring it occasionally. Great care must be taken in its preparation to prevent overheating, as this would result in the decomposition of the indigo, yielding indigo green and sulphurous acid.

(57) J. S.—The pancratic eyepiece has its best position for definition. They are not much in use for ordinary telescopes. If necessary, use two eyepieces. The power to read or define print at a distance depends more upon the perfection of the object glass than upon its size. You may be able to read the SCIENTIFIC AMERICAN at from 500 to 2,000 feet, using powers up to 200.

(58) G. W. T. asks: Will you please be kind enough to give me your ideas about concrete for foundations for houses? Which is the most durable and least liable to give—concrete or piles? I wish to build on a lot which is not very solid ground, and do not know which to use for a foundation. A. If the soil of your lot is simply weak, dig trenches and fill in with concrete composed of 1 part of good Portland cement to 4 parts of gravel, broken stones, or pieces of hard brick, not larger than a hen's egg, and 2 parts of clean, sharp sand. Piles are principally employed where the uncertainty of the ground goes down deeply.

(59) R. W.—Many of the bricks now used throughout the country are made without the impression, or "frog," as it is called. Those which are wire-cut never have them, and many of the hand-made bricks are not provided with them. It is very doubtful indeed whether the frog is of any practical advantage, in fact, the generally accepted opinion now is that it is a detriment rather than otherwise, as it needlessly increases the quantity of mortar in a wall, and therefore weakens it. The object of the mortar is nothing beyond forming an adhesive substance between the bricks, and it is difficult to see how the frog can assist such adhesion, which, with good mortar and bricks properly laid and well wetted previously, should be perfect. The Philadelphia red pressed brick is an excellent one for facings.

(60) H. W. W. asks concerning the SCIENTIFIC AMERICAN SUPPLEMENT, No. 535, article headed, "The Condensation of Fumes by Static Electricity," will you please to inform me what material it will be necessary to use in making the combs? Also if sufficient power can be got from cell batteries? A. The combs may be made of any metal—steel, brass, or iron. Electricity of higher tension is needed than a cell battery will give. Use a frictional or induction machine, as directed in the article; or a cell battery with an induction coil would answer.

(61) W. J. W. asks if it is an admitted fact that the clouds have to attain a certain height before it thunders. A. There is no reason for believing that such is the case. As thunder and lightning are the result of an electric discharge between the earth and the clouds, they are dependent only upon the electrical condition of the clouds and the resistance of the atmosphere. The distance through which such discharge is possible will therefore vary with these conditions.

(62) G. A. H. desires a process for bleaching bones. A. By immersing for a short time in water containing a little sulphurous acid, chloride of lime, or chlorine. See "Peroxide of Hydrogen," contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 339.

(63) H. S.—There is no difference observable to the eye between mammoth and medium clover seed. Salt that is found in the earth was deposited in the early geological ages, the localities being inland salt lakes or lagoons from the sea, the constant evaporation causing a deposit of salt, as in the great salt lakes of Utah and Nevada. The salt beds, afterward becoming covered with earthy material, were preserved as we find them. Salt is a chemical compound of chlorine and sodium, and is necessary to the animal economy as health preserving and a stimulant to digestion.

(64) N. P. M. asks: What will best remove moss and weather discolorations from marble monuments and gravestones? A. Take equal parts of caustic potash, quicklime, and soft soap, make them into a thick paste with water, and apply with a brush; leave for about a week, and apply again and again until the stains have disappeared. A weak solution of aqua fortis or nitric acid may be used if preferred.

(65) D. B. K. asks how to make an insoluble glue suitable for gluing split bamboo fish rods. A. Take of gum shellac 3 parts, India rubber 1 part, by weight. Dissolve the rubber and shellac in separate vessels in ether, free from alcohol, applying a gentle heat. When thoroughly dissolved, mix the two solutions, and keep in a bottle tightly stoppered. This glue resists the action of water, both hot and cold, and most of the acids and alkalies. The addition of not over 2 per cent of potassium bichromate to a solution of glue, and subsequent exposure of the glued parts to the sunlight, will make an insoluble cement.

(66) Reno asks how to polish black walnut with oil, and what kind of oil to use. A. Mix with good whiting such colors as will produce as near as possible the color of the wood to be filled. This mixture to be dry. Then give the wood a good coat of oil, and sprinkle the mixture over the work until it is pretty well covered; then with a soft rag or other soft substance rub this on well. When the filling is satisfactory, finish with linseed oil, put on with a brush, wipe off, and rub to a polish with fine cotton; finish with a silk handkerchief or any fine fabric.

(67) L. A. B. desires a recipe for making a violet sachet powder for perfuming clothes, note paper, etc. A. Take of powdered rose leaves or orris root 3 pounds, powdered bergamot peel 1 pound, powdered cloves and cinnamon each 6 ounces, powdered acacia and orange flowers each 8 ounces, starch 3 pounds.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

I. G. G. R.—Wad (manganese oxides) on basalt or trachyte. We should like to have communicated to us the locality where this mineral was found.—H. H. C.—Your specimen is probably part of the stem of fossil radiate of the general name of crinoids. It has, we think, been artificially polished. It is of no value.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

April 20, 1886,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising machine, J. Castle 340,285
Air compressor, hydraulic, J. B. Erwin 340,496
Alarm apparatus, automatic, C. L. Horack 340,441
Amalgamating, B. S. Harback 340,504
Animal trap, W. B. Wiggins 340,269
Axle box brass, car, Reynolds & Murray 340,361
Bag. See Paper bag.
Bag and satchel frame, W. Roemer 340,459
Bagasse burner, G. W. Fisher 340,302
Baker's pan or tray, H. S. Dosh 340,492
Band for packages, I. E. Palmer 340,288
Barrel, ventilated, J. C. Dozier, Jr 340,493
Battery. See Electric battery.
Beads, machine for making metallic, Lyon & Macomber 340,515
Bed rest, invalid, C. F. Lilley 340,334
Bed, wardrobe, J. J. Adgate 340,072
Bedstead, W. J. Myers 340,147
Bee trap, W. P. Hamlin 340,114
Beer and water cooler, J. F. Shomate 340,377
Bell cord coupling, electric, H. B. Cox 340,426
Bell cord, electric, H. B. Cox 340,425
Belt and suspender, combined, J. Adler 340,155
Belting for driving machinery, A. Broadnax 340,280
Bit. See Boring and routing bit.
Blast oven, hot, V. O. Strobel 340,163
Blind or shutter for windows, J. Thornton 340,387
Block. See Paving block. Stereotype block.
Boiler. See Steam boiler.
Boiler attachment, W. Donegan 340,200
Boilers, firebox for, J. T. Corbett 340,102
Bolt machine, Hall & Young 340,306
Bolt machine, G. J. Murdock 340,518
Bolting reel, B. Kniffler 340,446
Boot or shoe, H. T. Marshall 340,135
Boot or shoe jack, E. D. Lee 340,331
Boot or shoe, rubber, F. M. Shepard 340,374
Boot or shoe sole, F. F. Raymond, 2d 340,358
Boot or shoe stiffener, W. H. Watson 340,177
Boring and routing bit, T. D. Cook 340,100
Bottle capping machine, A. Caldwell 340,417
Bottle stopper, B. K. Dorwart 340,201
Box. See File box.
Box for washing material for concrete, T. W. Carrico 340,484
Brake. See Railway brake. Wagon brake.
Brick kiln, W. Alsip 340,186
Bricks, etc., machine for pressing plastic material into, G. Carnell 340,284
Brushes, machine for making, L. Young 340,184
Buckle, C. W. Wheeler 340,469
Buckle, suspender, C. B. Bird 340,088, 340,089
Buffing wheel gauge, R. Binno 340,086
Bullets, producing and swaging, D. S. Trimmer 340,171
Burner. See Bagasse burner. Oil burner.
Bustle, J. J. Hoppes 340,317
Button making machine, W. Hornich 340,442
Cages, perch and food holder for, G. C. Hinman 340,116
Can. See Milk and cream can.
Cap for flasks, etc., W. C. Johnson 340,443
Car brake, J. W. Owens 340,149
Car coupling, A. Armitage 340,473
Car coupling, W. Conner 340,099
Car coupling, J. P. Eakin 340,298
Car coupling, I. Hammond 340,209
Car coupling, G. H. Lipe 340,447
Car coupling, L. Merrill 340,235
Car coupling, J. W. Rykard 340,525
Car coupling, C. R. Tunks 340,529
Car coupling, H. Wallace 340,261
Car doors, indicator lock for, H. A. De La Hooke 340,427
Car heater, railway, C. Turner 340,258
Car platform gates, device for operating, W. Haslam 340,309
Car, railway, E. W. Furrell 340,206
Cars, cable traction for street, O. H. Jadwin 340,320
Carburetor, R. S. Lawrence 340,221
Carding machines, mechanism for stripping the flat cards of, E. W. Thomas 340,167
Carriage, R. S. Tucker 340,466
Carriage top joint, C. F. Dernell 340,105
Cartridge shells, machine for feeding, J. V. Meigs 340,234
Carving apparatus, R. B. Codling 340,288
Caster, R. S. Thompson 340,170
Casting teeth for diamond saws, mould for, E. Foerster 340,204
Cement, etc., manufacturing, F. Ransome 340,357
Chain, drive, F. Eckstein, Jr 340,300
Chair. See Railway rail joint chair.
Charm and cigar cutter, combined watch, Heath & Fredricks 340,212
Chart, anatomical, L. W. Yaggy 340,270
Chart, star time, J. B. Morse 340,452
Chimney and ventilator, combined, J. S. Eberhart 340,299
Chimney and ventilator, combined, S. W. Skipworth 340,379
Churn, W. M. Cline 340,194
Churn, P. Hauersperger 340,115
Churn, A. J. Ramsey 340,154
Chute or waterway, screened, L. B. Wells 340,264
Cigar bunching machine, F. C. Smalstig 340,380
Cigar press, A. Rein 340,359
Cigar wrappers, machine for cutting, J. R. Williams 340,180
Clamp. See Floor clamp. Pie crust clamp.
Clock system, electric, J. E. Carey 340,483
Closet. See Water closet.
Clocks, indicator for gas, Eaton & Cash 340,495
Coffee and peanut roaster, C. L. Cole 340,289
Coffee roaster, M. A. Laska 340,328
Coin counter, Wahler & Leber 340,392
Collar, horse, Ambrose & Atkins 340,187
Collar pad, horse, Hurlburt & Havens 340,509
Colors, wrapping, K. Edge 340,484
Colter, fastening, H. Heidacker 340,506
Colter, rotary, J. Feger 340,301
Colter, self-clearing breaking plow, B. C. Brownell 340,281
Concentrating and amalgamating machine, H. B. Meech 340,142
Condenser, L. Briggs 340,279
Condenser, steam, E. Baumann 340,084
Conductor, underground, D. H. Dorsett 340,431
Conduit for electric conductors, D. H. Dorsett, 340,432, 340,433
Conduit, hot blast, F. W. Gordon 340,110
Conveyer, J. A. Jeffrey 340,321
Cooler. See Beer and water cooler.
Coop, chicken, E. Modlin 340,144
Cop winding machine, S. W. Holman 340,315
Cords or braids to textile fabrics, etc., method of and machine for fixing, E. Cornely 340,422
Corn hiller and cultivator, combined, E. Minnich 340,345
Corpse preserver, S. Stockton 340,528
Corset stays, machine for covering, Nettleton & Littlejohn 340,347
Cotton and hay press, W. H. Tappey 340,164
Cotton gin, W. Dearborn 340,294
Couch, reclining chair, C. A. Lindner 340,131
Coupling. See Bell cord coupling. Car coupling. Thill coupling.
Crusher. See Ore crusher.
Cultivator, N. H. Shepardson 340,375
Cultivator, sulky, W. R. McConnell 340,138
Cutter. See Tube cutter.
Damper, stovepipe, G. C. Frazer 340,500
Desk and seat for same, adjustable, A. Mauchain. 340,341
Disease germs in sanitary appliances, destroying, A. Edwards 340,202
Distilling hydrocarbon oil, process of and apparatus for, H. Frasch 340,499
Ditching and tile laying machine, E. G. Hastings. 340,505
Ditching machine, R. H. Kersey 340,128
Ditching machine, J. McLachlan 340,141
Door check, J. Meredith 340,143
Door hanger, sliding, Palmer & Thompson 340,150
Drier. See Fruit drier. Tobacco drier.
Drill. See Grain drill.
Drill frame, quarry, W. L. Saunders 340,251
Driving apparatus, C. Lowther 340,513
Dust pan holder, D. H. Murphy 340,146
Electric battery and means for emptying and recharging it with the exciting fluid, J. T. Armstrong 340,474
Electric current indicator, E. Weston 340,403
Electric lighting, system for, E. Weston 340,404
Electric lights, manufacture of carbon conductors for incandescent, E. Weston 340,397
Electric machine, dynamo, E. Weston 340,395
Electrical indicator, E. Weston 340,399
Electrical switch, E. Weston 340,401
Embroidery holder, J. B. West 340,265
Engine. See Gas engine. Pressure engine.
Engraver's turntable or holder, J. R. Dickson 340,429
Envelope blank feeding mechanism, F. H. Richards 340,245
Envelope blanks, mechanism for creasing, F. H. Richards 340,246
Envelope machine, F. H. Richards 340,244, 340,250
Envelope machines, picker for, F. H. Richards 340,249
Envelopes, etc., holder for, P. Ramser 340,355
Envelopes, machine for counting, packing and banding, F. H. Richards 340,243
Explosive compound, M. Bielefeldt 340,276
Extension table, G. Schmitt 340,368
Farm gate, G. Shine 340,376
Faucet, self-closing, H. B. Leach 340,329
Fence machine, A. R. Conger 340,421
Fence post, J. D. Cox 340,292
Fence post, G. W. McEwen 340,139
Fence posts, wire fastening device for metallic, W. B. Hayden 340,311
Fences, machine for making slat and wire, M. Keller 340,324
Fences, machine for manufacturing, R. J. Aultman 340,476
Fencing, apparatus for automatically stopping machines for making wire, J. D. Curtis 340,198
Fencing, machine for manufacturing barbed, J. D. Curtis 340,196
Fertilizer distributer, S. W. Jackson 340,217
Fibrous materials, machine for combing, H. Truxler 340,172
File box, W. H. H. Clague 340,094
File, newspaper, J. Habitzreiter 340,305
Filtering device or stone, R. L. De Lisser 340,295
Firearm, S. J. Buzzini 340,482
Firearm, breech-loading, Card & Cruttenden 340,283
Firearm, breech-loading, R. A. Berger 340,192
Fire extinguishing apparatus, W. Harkness 340,210
Fire extinguishing apparatus, E. Kendall 340,127
Flier, J. A. V. Smith 340,388
Float, A. J. Wright 340,534
Flood gate, J. Dailey 340,298
Floor clamp, Moses & Hawley 340,145
Fly trap, C. Anderson 340,471
Folding machine, D. Appel 340,080
Folding table, H. T. Birchard 340,087
Fountain. See Parlor fountain.
Frame. See Bag and satchel frame. Drill frame.
Fruit drier, Burner & Anderson 340,480
Fruit jar, J. L. & E. A. De Steiger 340,428
Fuel, feeding, J. T. Corbett 340,101
Furnace, Grewcox & Yeiter 340,502
Gauge. See Buffing wheel gauge. Plow gauge.
Gas and stench trap, sewer, T. Shehan 340,255
Gas burners, automatic cut-off for, Smiley & Stombs 340,381
Gas engine, N. E. Nash 340,453
Gas into illuminating gas, converting natural, J. McKay 340,231
Gas mains, pipe joint for, G. Westinghouse, Jr., 340,267, 340,268
Gas mains, preventing leakage in, G. Westinghouse, Jr 340,266
Gas making apparatus, E. S. Bryant *et al* 340,282
Gas meters, pressure regulator, for proportional, F. Moore 340,450
Gas, odorizing, C. Haslett 340,310
Gas pipes, cut-off for natural, G. Russell 340,524
Gas regulator, H. H. Gridley 340,112
Gas regulator, A. F. Olds 340,454
Gas, treating natural, J. McKay 340,232
Gate. See Farm gate. Flood gate.
Gate, J. E. Covert 340,424
Gate, D. Slauson 340,160
Generator. See Steam generator.
Glass beveling machine, N. Vogley 340,260
Glass, imitating stained, A. M. F. Caspar 340,485
Glass, lead for setting stained, J. Pfleging 340,353
Glassware, manufacture of, G. W. Blair (r) 10,712
Goods, making-up board for piece, C. Priestley 340,521
Grader and ditcher, combined, G. D. Huffman 340,119
Grain binder, C. Miller 340,342

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Grain drill, H. C. Beebe 340,190
Grain drill attachment, J. Courson 340,103
Grain separator, W. E. Howarth 340,215
Griddles, etc., hinge for cake, S. A. Gould 340,208
Grinding mill, C. Abele 340,271
Grooving and seaming machine, P. Birch 340,413
Gun, magazine, A. Burgess 340,479
Hammock support, H. A. Adams 340,071
Hammocks, suspension device for, I. E. Palmer .. 340,239
Hanger. See Door hanger. Picture frame hanger.
Harness, W. H. Gibbens 340,304
Harrow, P. Meyer 340,236
Harvester and binding machine, C. Calahan 340,095
Harvester, corn, H. Roberts 340,365
Harvester, grain binding, C. Colahan 340,096
Harvester sickle, Ritter, Jr., & Van Ritter 340,364
Hats, device for supporting, A. T. Clason 340,419
Hay and cotton press, H. G. Hansen 340,307
Hay knife G. F. Weymouth (r) 10,715
Hay rake and carrier, horse, B. Jackson 340,122
Hay rake, horse, Kienardt & Funk 340,326
Heater. See Car heater.
Holder. See Dust pan holder. Embroidery holder. Lamp holder. Lantern and flag holder. Paper holder. Pen and brush holder. Tool holder. Type holder.
Horseshoe, C. W. Hayes 340,440
Horseshoe machine, C. H. Perkins 340,350
Ice creeper, J. G. Skinner 340,378
Ice cutting machine, R. S. Elliott *et al* 340,435
Ice scraper, J. T. Thompson 340,169
Incandescents, making, E. Weston 340,402
Indicator. See Electric current indicator.
Ironing machine, Lieb & Hines 340,225
Jack. See Boot or shoe jack.
Jar. See Fruit jar.
Jewel, rotary, H. & G. Gaensslen 340,108
Joint. See Carriage top joint.
Key. See Telegraph key.
Keyways, machine for cutting, J. L. Oefinger 340,348
Kiln. See Brick kiln.
Lamp, E. L. Bryant 340,416
Lamp, electric, L. G. Woolley 340,182
Lamp extinguisher, J. Philippi 340,457
Lamp holder, incandescent, E. Weston 340,400
Lamp, incandescent, E. Weston 340,396
Lamps, cut-out instrument for incandescent, Little & McDonald 340,448
Lamps, suspending device for electric, P. Krautz. 340,512
Land roller, S. J. Fisher 340,437
Lantern and flag holder, signal, Briggs & Clark 340,090
Lantern frames, manufacture of tubular parts of, L. F. Betts 340,274
Latch, F. Keil 340,333
Lathe, A. Gordon 340,207
Lathes, work support for, E. Zimmermann 340,535
Lathing, L. S. Scott 340,253
Lawn edge trimmer, T. & W. H. Coldwell 340,420
Lifter. See Pot lifter.
Line, driving, R. H. Mullen 340,517
Link, J. Scott, Jr. 340,158
Lock. See Nut lock. Padlock. Seal lock.
Locomotive smokestacks, attachment for, C. Turner 340,259
Locomotives with hot water, feeding, A. Lencauchez 340,222
Log skidding and loading machine, H. N. Hewlett 340,312
Loom shuttle, W. H. Spencer 340,463
Looms, positive shuttle motion for, C. B. Rumsey 340,523
Looms, variable take-up motion for, G. F. Hutchins 340,216
Lubricator. See Steam engine lubricator.
Lubricator, W. T. Smith 340,385
Lubricating purposes, grease feeder for, C. A. Thompson 340,256
Mandrel, expanding, H. Cottrell 340,291
Mechanical movement, T. A. Macaulay 340,227
Mechanical movement, F. H. Richards, 340,156, 340,247, 340,248
Metals, preparing moulds for the electro-deposition of, L. H. Rogers 340,460
Milk and cream can, Albaugh & Gibbs 340,409
Mill. See Grinding mill.
Moulding machine, sand, A. Rice 340,362
Motive power, applying, Masters & Corey 340,229
Motor. See Water motor.
Movement cure apparatus, W. F. Worthmeyer 340,533
Mower, lawn, T. J. Perrin 340,240
Mowing machines, shoe for, G. H. Bartlett 340,083
Music stand, folding, O. S. Vaughan 340,391
Necktie, M. K. Burger 340,478
Necktie fastener, G. D. Burton 340,481
Nickel and silver, or platinum, forming compound plates of, M. L'Epine 340,223
Nut lock, H. A. Harvey 340,308
Nut tapping machine, E. N. Beecher 340,191
Oil burner, Wilcox & Bunnell 340,179
Oil for lamps and resulting product, preparing burning, J. Roots 340,522
Oils, treating mineral, C. L. Baillard 340,411
Ore crusher, T. Archer, Jr 340,472
Organ, cabinet pipe, Roosevelt & Haskell 340,461
Oven, baker's, S. M. Raines 340,354
Pad. See Collar pad.
Padlock, M. Jackson 340,319
Pan. See Baker's pan.
Paper bag, D. Appel ..... 340,074 to 340,076, 340,078, 340,079
Paper bag machine, D. Appel 340,081
Paper folding machine, D. Appel 340,077
Paper holder, M. Lester, Jr 340,224
Paper making machine, W. A. Lindsay 340,335
Parlor fountain, self-acting, J. Kesel 340,129
Pavement, F. G. Johnson 340,123
Paving block, A. Pimm 340,153
Pen and brush holder, D. B. Smith 340,382
Pen, fountain, C. W. Taylor 340,166
Pen rack or pen and pencil holder, J. M. Keep 340,322
Pencil, lead, Cotterill & Conner, Jr 340,423
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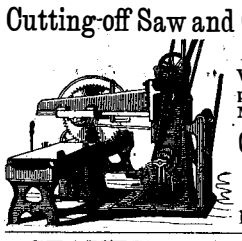

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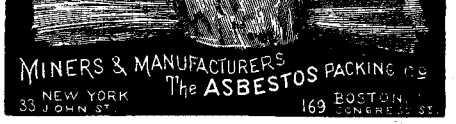

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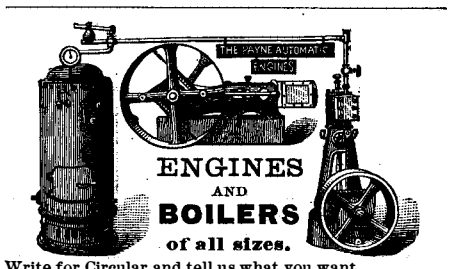

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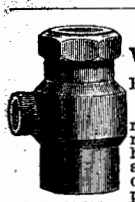

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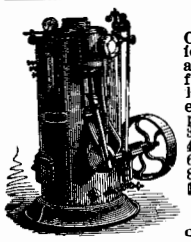

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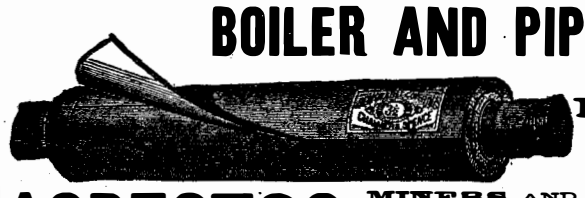

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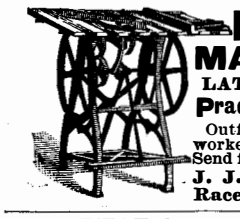

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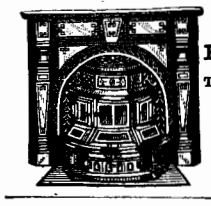

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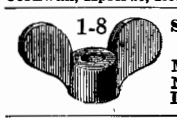

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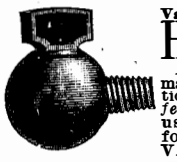

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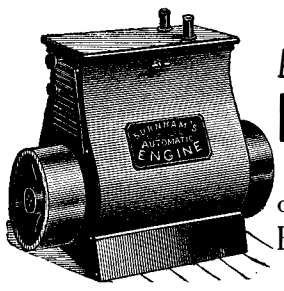

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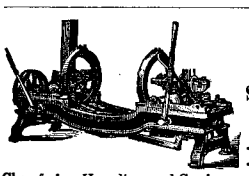

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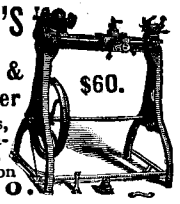

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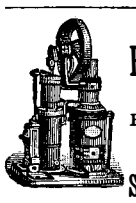

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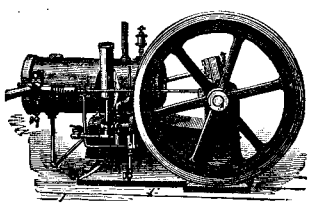

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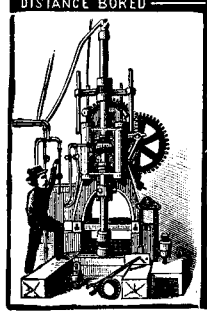

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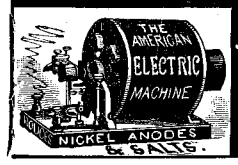

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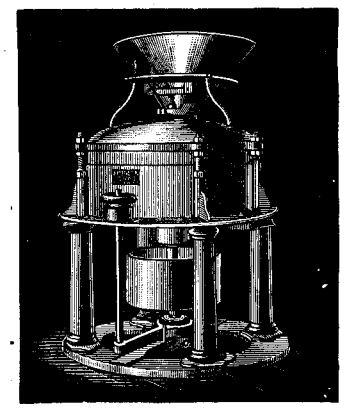

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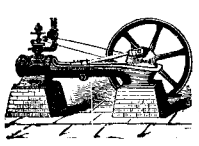

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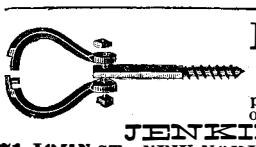

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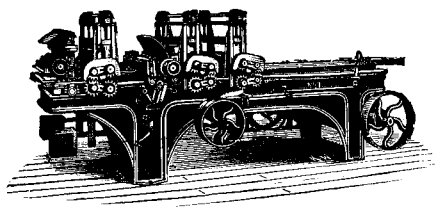

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